DOE/RL-90-37
Revision 2

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REMEDIAL INVESTIGATION PHASE 2 SUPPLEMENTAL WORK PLAN FOR THE HANFORD SITE 1100-EM-1 OPERABLE UNIT

EXECUTIVE SUMMARY

The Remedial Investigation (RI) Phase II Supplemental Work Plan for the Hanford Site 1100-EM-1 Operable Unit (DOE/RL-90-37) defines the tasks necessary to complete characterization of the 1100 area in preparation for remedial activities. In the past year, the United States Environmental Protection Agency (EPA), the United States Department of Energy (DOE), and the Washington State Department of Ecology (Ecology) have renegotiated issues which were determined to be inappropriately or insufficiently addressed in past versions of the Work Plan. These issues include groundwater characterization underlying the Horn Rapids Landfill (HRL) and the nearby Siemens Nuclear Power Corporation (SNP) property, as well as vadose zone and geophysical surveys at HRL.

This revised work plan provides a description of new tasks and highlights quality assurance (QA) procedures and significant changes to milestones. A principal milestone was renegotiated combining the Phase II RI, milestone M-15-01B, and the Phase III FS, milestone M-15-01C to become one final deliverable M-15-01B/C with the new submittal date of December 1992. Completion of remediation efforts on the 1100-EM-1 area became the responsibility of the U.S. Army Corps of Engineers (USACE), Walla Walla District (CENPW) as of October 1, 1991. To ensure compliance with imminent milestones, Westinghouse Hanford Company (WHC) has continued to work in the 1100 area under the new jurisdiction of USACE. CENPW is now responsible for coordination of the transition of tasks and analytical services already initiated by WHC, and, also, for planned tasks and services to be conducted by USACE in the 1100 area. Previously approved QA procedures (appendix A) prepared by WHC are applicable to activities underway or completed by WHC. CENPW will follow protocol provided in appendices B,C, and D, and other CENPW documents for all subsequent remedial activities at the 1100-EM-1 Operable Unit.

The 1100-EM-1 Operable Unit is one of four operable units within the 1100 area of the Hanford Site, which was placed on the National Priorities List in July 1989. A Phase I RI report for the 1100-EM-1 Operable Unit was completed in August 1990, and a Phase I and II feasibility study report was submitted in December 1990.

The Phase I RI recommended that additional characterization of the 1100-EM-1 Operable Unit focus on the 1100-1 (Battery Acid Pit), 1100-2 (Paint and Solvent Pit), 1100-4 (Antifreeze Tank Site), UN-1100-6 (Discolored Soil Site), Horn Rapids Landfill (HRL), the Ephemeral Pool, and the South Pit. The following paragraphs summarize Phase I RI data as well as the status of data generated subsequent to the Phase I RI relevant to each of the sites.

- 1100-1 (Battery Acid Pit) — The Phase I RI groundwater sampling results indicated elevated gross-alpha and gross-beta radiation levels in the vicinity of the 1171 Building adjacent to the pit. However, additional rounds of groundwater monitoring completed after the publication of the Phase I RI Report have not confirmed the existence of elevated levels of radioactivity (GAI 1991a).
- 1100-2 (Paint and Solvent Pit) — Tetrachloroethene was detected during the Phase I RI soil gas survey, and also in groundwater samples from a nearby, cross-gradient

monitoring well at low concentrations. During the Phase II RI, a single groundwater monitoring well was installed immediately downgradient from 1100-2 to determine if a plume of tetrachloroethene is migrating from the Paint and Solvent Pit. Groundwater monitoring results for that well shows concentrations below guidelines. Installation of additional wells is not warranted based on available data. Reevaluation of the need for additional wells will occur when future monitoring well results are reviewed.

- 1100-4 (Antifreeze Tank Site) — The Phase I RI groundwater sampling results indicate elevated gross-alpha and gross-beta radiation levels in the vicinity of the 1171 Building. However, additional results of groundwater monitoring completed after the publication of the Phase I RI Report do not confirm the existence of elevated levels of radioactivity (GAI 1991a).

- UN-1100-6 (Discolored Soil Site) — Surface soils at UN-1100-6 are contaminated with bis(2-ethylhexyl)phthalate at levels that may pose a low risk to workers at this operable subunit. Plans for an expedited removal action were proposed for the bis(2-ethylhexyl)phthalate but rejected by the Regulators. The Phase I RI surface soil sampling also indicates the presence of low concentrations of 1,1,1-trichloroethane. Phase II soil gas probes were installed at nine locations. No target compounds were detected in any samples at noteworthy concentrations above the laboratory blanks. No additional characterization activities are planned for this subunit.

- Horn Rapids Landfill — During the Phase I RI, anecdotal information was discovered suggesting that as many as 200 barrels of carbon tetrachloride may have been buried at HRL. Soil sampling during the Phase I RI detected elevated concentrations of polychlorinated biphenyls at levels of concern that may pose a low risk to workers at the operable subunit. Groundwater in the vicinity of HRL, also, contains elevated levels of nitrate, trichloroethene (TCE), and radioactivity that cannot be attributed to the HRL based on Phase I RI data.

  Further characterization at the HRL was negotiated with the Regulators. A geophysical survey to detect the presence of concentrations of 10 or more drums was conducted; soil sampling was conducted to delineate the extent of the polychlorinated biphenyl contamination; shallow borings were advanced in areas of known disturbances; test pits were excavated at selected sites to characterize further anomalous areas identified by geophysical surveys.

  A soil gas survey utilizing 53 probe locations was conducted to delineate the groundwater trichloroethene plume. Thirty-five permanent soil gas probes were installed to monitor for releases of containerized liquid hazardous wastes potentially buried in the landfill. Results of the soil gas surveys gathered during three separate sampling events do not indicate the presence of a concentrated vadose zone source for TCE or other Volatile Organic Compounds (VOC's) near the locations sampled (GAI 1991c).

Further negotiations with the Regulators resulted in agreements to stop further groundwater plume delineation, aquifer characterization (pump testing), upgradient monitoring well installation, and soil gas sampling.

- Ephemeral Pool — Elevated levels of polychlorinated biphenyls are present in the surface soils of this parking lot runoff basin. Soil sampling to delineate contamination has been completed and no further characterization is planned.

- South Pit — During the Phase I RI this potential disposal area was identified from historic aerial photographs and was scheduled for characterization for possible Hanford Site related use and contamination. Geophysical surveys were completed and 40 soil gas probes were installed and sampled at the South Pit. The results of the soil gas sampling do not indicate the presence of a concentrated vadose zone source for TCE or other VOC's near the locations sampled (GAI 1991c). Following presentation and discussion of the geophysical and soil gas survey results at the Unit Managers Meeting, December 19, 1990, further characterization (soil sampling) was not indicated. SNP is preparing for a source investigation which includes the South Pit. If data from the SNP investigation is received in time, it will be included in the Final Remedial Investigation and Feasibility Study Report.

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- Horn Rapids Landfill—a solid waste facility used primarily for the disposal of office and construction waste and the burning of classified documents; asbestos, sewage sludge, fly ash, and, potentially, drums of unidentified organic liquids alleged to be disposed at this location

- Ephemeral Pool—the location of 1100 Area parking lot runoff accumulation during infrequent, high-intensity precipitation events.

Three waste management units and one miscellaneous location are not considered for additional work during the Phase II RI (see figure 2-1): 1100-3 Antifreeze and Degreaser Pit, UN-1100-5 Radiation Contamination Incident, Hanford Patrol Academy Demolition Site, and Pit 1. The 1100-3 operable subunit was considered to pose no significant contamination problems after evaluation of Phase I data collection activities. The UN-1100-5 operable subunit was considered to pose no significant contamination problem; no radioactivity was found on the 1100 Area parking lot surface, and enough time has elapsed since the release such that the radioisotopes involved are virtually completely decayed. For the purposes of this report, the Hanford Patrol Academy Demolition Site was not regarded as part of the 1100-EM-1 Operable Unit. This waste management unit is a TSD (Treatment, Storage, Disposal) facility that, if necessary, will be addressed separately under Ecology's Resource Conservation and Recovery Act (RCRA) authority. Pit 1 was not considered to pose any significant contamination problem based on the evaluation of the samples collected during the Phase I RI.

Since the publication of Draft A of this work plan, the 1100-1 Battery Acid Pit and 1100-4 Antifreeze Tank Site waste management units are now not considered for work during the Phase II RI (see figure 2-1). These two operable subunits were considered for additional work at the conclusion of the Phase I RI because the first round of groundwater monitoring results indicated elevated gross-alpha and gross-beta radiation levels in the vicinity of the 1171 Building. Additional rounds of groundwater monitoring results have not confirmed the first round results (GAI 1991a). Therefore, no additional work at 1100-1 and 1100-4 is necessary.

There are several other waste management facilities in the vicinity of the 1100-EM-1 Operable Unit. These include two of the remaining three operable units that comprise the 1100 Area NPL Site (the 1100-EM-2 and 1100-EM-3 Operable Units), a potato processing plant, a private nuclear fuel manufacturing facility, the Hanford Site nuclear fuel fabrication and research and development complex (the 300 Area), and the Richland Municipal Landfill. Historical aerial photographs (EPA 1990) indicate surface disturbances south of the HRL. This area of disturbance may have been used for waste disposal and is referred to as the South Pit (see figure 2-1).

The 1100-EM-1 Operable unit is situated within an area possessing a relatively moderate climate characterized by low precipitation, high evapotranspiration and light winds. Annual precipitation falls mainly in the winter months. Precipitation events are predominantly short in duration, but occasionally contain heavy rainfall. The relatively flat topography and limited precipitation, provides little water to generate runoff. No significant water bodies are located within or immediately adjacent to the operable unit; however the Columbia River, an important regional surface water resource, is located approximately 1.5 to 1.8 km (.9 to 1.1 mi) to the east of the operable unit.

The operable unit is underlain by massive basalt flows that form the regional bedrock. The uppermost basalt flow in the area of the 1100-EM-1 Operable Unit is part of the Ice Harbor

Member of the Saddle Mountains Basalt Formation. Overlying the bedrock is the Ringold Formation, an approximately 43- to 52-m (142- to 170-ft) thick deposit of mixed sediments of fluvial and lacustrine origin. The upper portion of this formation consists of sandy gravels, gravelly sands, silty sandy gravels, and silty gravelly sands, with discontinuous sand lenses. Where penetrated by wells drilled for the Phase I RI, these coarse-grained sediments are underlain by finer-grained silts, clays, sandy silts, and sands. Based on published well logs, the Ringold Formation, at depths below those drilled for the Phase I RI, consists of silts, clays, gravels, gravelly sands, sands, and silty sands.

Above the Ringold Formation is the Hanford formation, the dominant facies of which is the Pasco gravels, a variable mixture of boulders, cobbles, pebbles, sands, and silts of glaciofluvial origin. Most of this formation, which is approximately 8- to 17-m (25- to 56-ft) thick at the operable unit, can be classified as unconsolidated basaltic sandy gravels to gravelly sands and silty sandy gravels. Eolian deposits form a thin veneer (< 0.3-m to 6-m [1- to 20-ft] thick) over the Hanford formation in the area of the operable unit. These deposits consist of moderately-to-well-sorted, very-fine-to-medium-grained sands or silty sands that were originally derived from the Hanford formation.

The soils of the operable unit are primarily classified as regosols, and are largely dominated by the characteristics of the parent materials from which they are derived. The moisture content of these soils ranges from 1 to 7%, and the soils contain only low amounts of organic matter.

An unconfined aquifer, underlain by a silt aquitard, occurs below the operable unit. The aquitard, which was observed throughout the operable unit vicinity, separates the unconfined aquifer from lower confined to semi-confined aquifers. There is, however, uncertainty regarding the continuity of the aquitard, and potential exists for the aquitard to be discontinuous. Regionally, the zone of recharge to the unconfined aquifer is located to the west of the operable unit, and the aquifer discharges to the east, in the Columbia River. Local groundwater flow, as measured in early March and late May of 1990, is easterly below most of the operable unit, but northeasterly in the vicinity of the HRL. The easterly flow in the southern portion of the operable unit indicates that groundwater passing beneath most of the operable subunits could pass through the City of Richland well field, which is located between the operable unit and the Columbia River.

This well field supplements the city's river-derived water supply during times of peak use; however, essentially all water obtained from the field is river water derived from large infiltration ponds around which the withdrawal wells are sited. When in use, large-volume infiltration creates a mound that diverts the regional groundwater flow around the field.

The Hanford Site land use is maintained through the Hanford Site development planning process. Land use on federal property is subject to federal approval and control. Compatibility with adjacent, non-federal, land use activities is maintained through coordination with local land use authorities. Approximately 45% of the Hanford Site is currently set aside as either wildlife or ecological reserves.

Lands adjacent to the 1100-EM-1 Operable Unit are zoned for industrial and commercial use; however, agricultural use is currently being allowed in a heavy-manufacturing-use zone to the west of the operable unit and a medium-industrial-use zone to the east. The nearest agricultural-use zones are about 1.8 km (1.1 mi) to the west of the operable unit, and the closest residential zone is approximately 0.8 km (0.5 mi) to the southeast of the 1100-1 Battery Acid Pit. County and city land-use plans and 1100 Area construction plans indicate that no significant changes in local land use are envisioned.

The Columbia River is the most significant surface-water body in the region. It serves as a source of drinking, industrial process, and irrigation water, and is used for various recreational activities. Groundwater in the vicinity of the operable unit is used primarily for environmental monitoring, irrigation, and limited domestic use; all residential areas in the vicinity have access to the city water supply. As mentioned earlier, groundwater derived from infiltrated river water is used to supplement the City of Richland water supply during times of peak seasonal demand.

No cultural resources, of either an archeological or historical significance, are located within the 1100-EM-1 Operable Unit.

The operable unit is located in a shrub-steppe vegetational zone characterized by the presence of a sagebrush/bunchgrass plant community in undisturbed areas and a cheatgrass/rabbitbrush/tumbleweed community in areas disturbed by human activities, such as the operable unit. No endangered, threatened, or sensitive plant species or communities are known to inhabit the operable unit vicinity.

The most abundant fauna apparent in the region are the grasshopper, horned lark, western meadowlark, Great Basin pocket mouse, cottontail rabbit, jackrabbit, various raptor species, coyote, and mule deer. The primary animal species of interest that inhabit the operable unit vicinity are the mule deer and two sensitive birds, the Swainson's hawk and the long-billed curlew.

No aquatic ecosystems are located on or adjacent to the operable unit; however, the Columbia River, while not supporting any endangered or threatened aquatic species, does support important populations of game fish, including various species of anadromous salmonids.

2.2 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination at the 1100-EM-1 Operable Unit are summarized below by the environmental media characterized during Phase I RI field activities: contaminant sources, air, soil, and groundwater. A detailed presentation of the nature and extent of operable unit contamination is found in the Phase I RI report (DOE-RL 90-18).

2.2.1 Contaminant Sources

The six operable subunits of interest were evaluated in detail with respect to their potential as primary or secondary sources of significant environmental contamination at the 1100-EM-1 Operable Unit. These subunits are: the 1100-1 Battery Acid Pit, the 1100-2 Paint and Solvent Pit, the 1100-4 Antifreeze Tank Site, the UN-1100-6 Discolored Soil Site, the HRL, and the Ephemeral Pool. Each subunit is briefly described in Section 2.1, above. Three other waste management units and a miscellaneous location, 1100-3, UN-1100-5, Hanford Patrol Academy Demolition Site, and Pit 1, respectively, are not given further detailed consideration in the Phase II RI for reasons specified in Section 2.1.

The original waste streams associated with each of the six operable subunits considered in this plan are no longer in existence. Therefore, the soils of these subunits are regarded as existing secondary sources of contamination. Soil contamination is summarized in Section 2.2.3 below.

Surface radiation surveys were conducted at each of the operable subunits, with the exception of UN-1100-6 and the Ephemeral Pool; the results of all such surveys were negative—no measurable radioactivity was encountered. Soil gas surveys were conducted at the 1100-1, 1100-2, and HRL operable subunits. Tetrachloroethene (PCE) was encountered within the soil gas of 1100-2 and the HRL, and trichloroethene (TCE) and 1,1,1-trichloroethane (TCA) were also found at the landfill.

Of the other nearby waste management facilities mentioned in Section 2.1, one—the SNP (SNP-formerly known as Advanced Nuclear Fuels Corp.) complex—is known to have contributed significant levels of contamination to operable unit groundwaters in the vicinity of the HRL. Contaminants known to have emanated from this facility are nitrate, fluoride, sulfate, ammonia, and gross-alpha and gross-beta radiation (Milton, J. and D. Bowhay, Ecology [Memo to R. Taylor, Ecology] October 31, 1986); Lockhaven, S., Advanced Nuclear Fuels Corp. [Letter to C. Cline, Ecology], January 12, 1990). The letter and memo cited are located in Phase I RI report (DOE-RL 90-18), appendix A, pages A1-13 and A2-69.

2.2.2 Air Contamination

One round of ambient air monitoring data was available for operable unit characterization; a second round of monitoring was conducted to assess potential occupational impacts during RI activities. The quantity and quality of these data are such that their utility is questionable; however, no indications of substantial deterioration of ambient air quality in the vicinity of the operable unit were found under the wind conditions present at the time the monitoring was conducted (DOE-RL 90-18; Glantz and Laws 1990).

2.2.3 Soil Contamination

Soils were sampled at each operable subunit, and analyzed for Target Analyte List (TAL) and Target Compound List (TCL) parameters. In addition, samples obtained from the 1100-4 subunit were analyzed for ethylene glycol, and certain samples from the HRL were analyzed for asbestos fibers. Results were compared to operable-unit-specific background concentrations to determine the contaminants present. Preliminary conservative toxicity screening was performed to determine contaminants of potential concern. Surface soils were considered to be those lying within .6 m (2 ft) of the ground surface. Surface soils are defined as extending to a depth of 4.5 m (15 ft.). Future soil evaluations will consider the 4.5 m (15 ft) requirement. Summarized below are the findings and conclusions from the Phase I RI report (DOE-RL 90-18). The findings are based on industrial land use. Consideration of other land uses may be appropriate in future evaluations.

- 1100-1 (Battery Acid Pit)—arsenic is the only contaminant of potential concern, encountered in the subsurface stratum in one sample at a concentration barely exceeding background levels
- 1100-2 (Paint and Solvent Pit)—chromium is the only soil column contaminant of potential concern, encountered in a single surface sample at a concentration not greatly in excess of background. In fact, the mean surface chromium concentration at 1100-2 is lower than the mean background concentration; PCE was encountered during the soil gas survey conducted under the source investigation (see Section 2.2.1)

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- 1100-4 (Antifreeze Tank Site)—the surface stratum of the soil column was not sampled at this subunit, but a concrete floor prevents direct contact with surface soils at this location; arsenic was found at elevated levels of potential concern, but only in a single sample obtained from below the water table

- UN-1100-6 (Discolored Soil Site)—only surface soils were sampled and analyzed at this subunit; the two contaminants of potential concern identified are bis(2-ethylhexyl)phthalate (BEHP) and chlordane; BEHP is present in percentage concentrations, and the distribution of the chlordane contamination is spatially correlated with the BEHP contamination

- Horn Rapids Landfill—both surface and subsurface soils were sampled and analyzed, but the subsurface sampling intentionally avoided areas of known and suspected waste deposition; the soil column contaminants of potential concern are polychlorinated biphenyls (PCB), chromium, and arsenic. PCB was detected at levels of potential concern at one subsurface and three surface locations; arsenic was encountered at levels of potential concern at one surface and two subsurface locations; chromium is more widely distributed, being found in 11 surface and eight subsurface locations at levels of potential concern; and TCE, PCE, and TCA were encountered in the gaseous phase of the landfill soils during the soil gas survey conducted for this subunit

- Ephemeral pool—two surface soil samples were obtained at this location; two contaminants of potential concern, PCB and chlordane, are identified—chlordane was found in both samples, and PCB in only one.

2.2.4 Groundwater Contamination

Twenty-nine monitoring wells throughout the 1100-EM-1 Operable Unit vicinity, and two distribution lines from the nearby City of Richland well field, were sampled during the Phase I RI field activities. Twenty-one wells were sampled in the first round of monitoring, and 29 in the second round. The well field distribution lines were sampled in both monitoring rounds.

The samples obtained were analyzed for conventional, TAL, and TCL parameters. Results were compared to operable-unit- or HRL-specific background concentrations, as appropriate, to determine the contaminants present. The determination of landfill-specific background was necessary due to the presence of the reported, upgradient SNP plume. Preliminary conservative toxicity screening was performed to determine contaminants of potential concern.

The only operable unit groundwater contaminant of potential concern identified, PCE, is present in a single well near the 1100-2 Paint and Solvent Pit; however, available data are currently insufficient to understand the magnitude and extent of this contamination.

Although existing data do not suggest operable unit sources, two other areas of groundwater contamination are present within the vicinity of the 1100-EM-1 Operable Unit. One is an area of generally deteriorated groundwater quality in the vicinity of the 1171 Building that contains elevated concentrations of several contaminant parameters, including gross-alpha radiation at levels that may be of interest. However, additional rounds of groundwater monitoring completed after the publication of the Phase I RI Report have not confirmed the existence of elevated levels of radioactivity (GAI 1991a).

The other groundwater contaminants appear to form a plume that originated upgradient from, and is passing beneath, the HRL. This plume is characterized primarily by the presence of high concentrations of TCE and nitrate, which, along with the operable unit contaminants of concern, are regarded as contaminants of interest (DOE-RL 90-18).

2.3 CONTAMINANT FATE AND TRANSPORT

The contaminant fate characteristics of nine contaminants of interest—arsenic, BEHP, chlordane, chromium, nitrate, PCB, PCE, TCA, and TCE—are discussed in the Phase I RI report (DOE-RL 90-18). These contaminants include the operable unit contaminants of potential concern and TCE and nitrate, the two groundwater contaminants that characterize what appears to be a plume of upgradient origin with respect to the HRL. Potentially operative contaminant transport pathways for the operable unit are qualitatively identified and quantitatively evaluated, where feasible, in the Phase I RI report (DOE-RL 90-18).

The relevant, potentially operative contaminant transport pathways for the 1100-EM-1 Operable Unit evaluated in the Phase I RI report were:

- Volatile emissions and atmospheric dispersion—PCE from 1100-2; TCE, PCE, and TCA from the HRL
- Fugitive dust emissions and atmospheric dispersion—BEHP from UN-1100-6; arsenic, chromium, and PCB from the HRL
- Direct contact of surface contamination—arsenic and chromium at 1100-3; BEHP and chlordane at UN-1100-6; arsenic, chromium, and PCB at the HRL; PCB and chlordane at the ephemeral pool
- Vadose-zone transport—considered to be insignificant
- Groundwater transport—TCE and nitrate in the vicinity of the HRL; available data are currently insufficient to evaluate PCE contamination associated with 1100-2
- Surface-water transport—PCE, TCE, and nitrate in the Columbia River from contaminated groundwater discharge
- Terrestrial biological transport—arsenic, chromium, and PCB to humans through mule deer, and to Swainson's hawks and long-billed curlews, at the HRL
- Aquatic biological transport—PCE, TCE, and nitrate uptake by fish in the Columbia River.

2.4 RISKS TO HUMAN HEALTH AND THE ENVIRONMENT

Section 6 of the Phase I RI (DOE-RL 90-18) provides a detailed assessment of the baseline risks, under current land- and water-use conditions, posed to human health and the environment by contaminant releases from and near the 1100-EM-1 Operable Unit. These findings are based on industrial land use. Consideration of other land uses may be appropriate in future evaluations.

Brief summaries of the human and environmental portions of this assessment are respectively provided in Sections 2.4.1 and 2.4.2 below.

2.4.1 Human Health Risks

Of the nine contaminants of interest at and near the 1100-EM-1 Operable Unit, none alone, on the basis of an assessment of a hypothetically most exposed individual, were shown to pose a significant threat to human health under current land- and water-use conditions. The overall risk associated with systemic toxicity is negligible and the overall risk associated with carcinogenicity is approximately 2E-06. These cumulative risks include not only all identified operable unit contaminants of potential concern, but also TCE and nitrate associated with a groundwater plume of apparent upgradient origin with respect to the HRL.

Approximately 90% of the overall cancer risk to the most exposed individual was attributed to two operable unit contaminants of concern, BEHP and PCB. The risk assessment indicated that the human population at risk for adverse effects of these two contaminants consists of workers having direct access to and job duties on the UN-1100-6 Discolored Soil Site, the HRL, and the Ephemeral Pool.

The BEHP poses a problem at the UN-1100-6 operable subunit, where it is present in surface soils in percentage concentrations. Ingestion and inhalation of these soils may increase cancer risks by about E-06. The Ephemeral Pool and the HRL have surficial PCB soil contamination. The ingestion and inhalation of contaminated soils at both facilities and the consumption of venison potentially contaminated by the landfill may also increase cancer risks by about E-06.

Exposure to contaminated groundwater downgradient of the 1100-2 operable subunit, or in the vicinities of the 1171 Building and the HRL, although dismissed as an operative pathway under existing land- and water-use conditions, could pose a human health hazard. Depending upon where a withdrawal well might be sited and how it may be used, a significantly increased cancer risk could be associated with PCE and TCE ingestion and inhalation, and a systemic toxic hazard could be posed by the ingestion of nitrate-contaminated groundwater. Insufficient data exist to determine whether ingestion of gross-alpha radiation could pose a significant risk.

The PCE is associated with the 1100-2 Paint and Solvent Pit, and the TCE and nitrate are associated with a plume in the vicinity of the HRL; however, existing groundwater data are not sufficient to prove the landfill, and thus the operable unit, to be the source of the latter two contaminants. The gross-alpha radiation appears to be associated with the 1171 Building. However, additional rounds of groundwater monitoring completed after the publication of the Phase I RI Report have not confirmed the existence of elevated levels of radioactivity.

2.4.2 Environmental Risks

Two sensitive bird species known to inhabit the HRL vicinity, the Swainson's hawk and the long-billed curlew, were selected as indicator species for the terrestrial environmental evaluation. Arsenic, chromium, and PCB, due to their presence in landfill surface soils, were the contaminants of potential concern for these species.

There is no evidence to support a conclusion of adverse contaminant impacts to the Swainson's hawks known to inhabit the landfill vicinity. A potential for such impacts, especially due to chromium, to the long-billed curlews that nest within and adjacent to the landfill can not be ruled out; however, the evaluation presented for this sensitive terrestrial community was simplistic and far from certain. The annual recurrence of both migratory species suggests that they are successfully reproducing. Putting the operable unit contamination problems into perspective, normal human activities (*e.g.*, clearing, construction, facility operations, pesticide application, and off-road vehicle use) probably pose the greater threat to both species and most other terrestrial organisms.

An environmental evaluation was also performed for the aquatic community of the Columbia River. Tetrachloroethene, derived from the discharge of 1100-2 vicinity groundwaters to the river, was the contaminant of potential concern for this community. TCE and nitrate, derived from the discharge of HRL vicinity groundwaters to the river, are additional contaminants of interest.

As nitrate is a readily assimilated essential nutrient for aquatic plants, and the levels that could be contributed to the river are insignificant, it should pose no risk to aquatic life. The comparison of a conservatively biased prediction of TCE concentrations in the Columbia River indicated, with a fair degree of certainty, that no adverse impacts to aquatic communities will occur. Operable unit characterization data are currently insufficient to allow for a quantitative evaluation of potential PCE impacts, but by analogy, it is unlikely that any adverse impact to aquatic life will occur.

3.0 WORK PLAN RATIONALE

The Phase I RI report (DOE-RL 90-18) provides a focused conceptual understanding of the 1100-EM-1 Operable Unit. Based on such an understanding, and on data needs for the FS, the report concludes with recommendations for further RI activities. These recommendations have been refined to develop the work scope for the Phase II RI.

In accordance with the TPA, the Phase II RI work scope was developed consistent with EPA's data quality objectives (DQO) process (EPA 1987a and 1987b) and McCain and Johnson (1990). This process is briefly described in Section 3.1, and the approach to conducting the Phase II RI for the 1100-EM-1 Operable Unit is outlined in a series of logic diagrams in Section 3.2.

3.1 DATA QUALITY OBJECTIVES PROCESS

The work scope for the 1100-EM-1 Operable Unit Phase II RI was developed consistent with EPA's DQO development process (EPA 1987a) and McCain and Johnson (1990). The EPA (1987b) explicitly states that they do not require specific DQO deliverables during the remedial response process. The manner in which the three-stage DQO process was used is briefly outlined below to provide an understanding of the logic behind the development of this work plan. The three stages are decision types identification (Section 3.1.1), data uses and needs identification (Section 3.1.2), and data collection program design (Section 3.1.3).

3.1.1 Stage 1—Identification of Decision Types

The first stage of the DQO process is the identification of decision types. There are four steps within this stage: (1) the identification and involvement of data users; (2) the evaluation of available data; (3) the development of an operable unit conceptual model; and (4) the specification of project objectives and decisions.

Identification and involvement of data users has been arranged on a programmatic basis for all Hanford Site environmental restoration activities through the TPA and associated program plans. On the project level, primary data users maintain close involvement in the DQO process through the opportunity to review and comment on project plans and reports.

The Phase I RI report for 1100-EM-1 provides a thorough interim evaluation of available data and presents these data in such a manner as to provide for a conceptual understanding of the operable unit. The final activity of the Stage 1 DQO process, the specification of project objectives and decisions for the Phase II RI, is documented by means of logic diagrams and brief objectives statements in Section 3.2 (Work Plan Approach); further details are provided in chapter 4.0 (Phase II RI Tasks).

3.1.2 Stage 2—Identification of Data Uses and Needs

The second stage of the DQO process consists of the identification of data uses and needs. This stage can be viewed as occurring in six steps: (1) the identification of data uses; (2) the identification of data types; (3) the identification of data quality needs; (4) the identification of data quantity needs; (5) the evaluation of sampling and analysis options; and (6) the review of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters.

Each Phase II RI task and its component activities were developed to provide data for a specific project use. Concise objectives statements are provided within this work plan to document the justification for each task and activity. Objectives statements in Section 3.2 are general in nature, while those presented on a task- or activity-specific basis in chapter 4.0 are more focused. Objectives statements are also referenced in the accompanying QAPP (appendix A) and QAPjP (appendix B).

The identification of data types required in the Phase II RI evolved from the identification of project-specific data gaps upon review of the Phase I RI report (DOE-RL 90-18). The scope of work presented in this plan was specifically developed to eliminate, to the extent practicable, such identified data gaps to a degree sufficient to allow the completion of the ongoing FS.

Data quality needs were identified upon consideration of integrated factors such as prioritized data uses, appropriate analytical levels, contaminants of concern (and those of potential concern or interest), contaminant levels of concern, analytical detection limits, and critical sample locations. The Phase II RI approach laid out in Section 3.2, and the required tasks presented and described in Chapter 4.0 and scheduled in chapter 5.0, are organized such that data will be collected in an efficient and cost-effective manner that will provide information for high priority overall project needs. Analytical methods and investigational techniques were selected within appropriate analytical levels (*e.g.*, screening methodologies versus standard methodologies), in accordance with EPA (1987a) and McCain and Johnson (1990), to help maximize the efficiency and cost effectiveness of the Phase II RI. The second phase of the operable unit investigation was designed to focus on those contaminants of either concern, potential concern, or interest that were identified in the Phase I RI report (DOE-RL 90-18). On the basis of the baseline risk assessment and the contaminant levels of concern presented in the Phase I RI report, analytical methodologies were selected, to the extent technically feasible, to provide detection limits low enough to allow for useful refinement of risk evaluations. Finally, chapter 4.0 sets forth means to provide for the characterization of critical locations and operable unit conditions (*e.g.*, to define the extent of significant environmental contamination attributable to 1100-EM-1, and to better define background conditions).

Due to uncertainties in regard to the extent of contamination in various environmental media, it is impossible to identify data quantity needs exactly. This problem is addressed by means of a staged approach to the Phase II RI. Data will be collected, analyzed, and evaluated in stages so that all involved parties can participate in deciding when the extent of contamination is well enough defined to allow FS completion.

Sampling and analysis options were evaluated in accordance with McCain and Johnson (1990). Selections were made on the basis of the data quality needs outlined above, and the applicability of relevant PARCC parameters, which are documented in the QAPP (see appendix A).

3.1.3 Stage 3—Design of Data Collection Program

The third and final stage of the DQO process consists of the design of a data collection program. Chapter 4.0 and appendix C (FSP) of this work plan present such data collection programs in detail. The associated QAPP in appendix A, QAPjP in appendix B, and other Hanford Site program and 1100-EM-1 project plans incorporated into this plan by reference, provide the mechanism by which the data collection program for the second phase of the 1100-EM-1 RI will be implemented, controlled, and documented.

3.2 WORK PLAN APPROACH

To provide information necessary to complete the FS, the Phase II RI will include the following integrated, subcomponent data collection tasks:

- Contaminant source investigation
- Pedological investigation
- Hydrogeological investigation
- Ecological investigation
- Geodetic control.

All or some of these tasks, as appropriate, will be conducted at each location in the operable unit. Figure 3-1 shows the investigational tasks as planned for five separate locations and operable-unit-wide tasks. Question marks are used in figure 3-1 to show where decision points occur. Tasks in locations with question marks may not be necessary, pending the results from preceding tasks. The contingent nature of such tasks is described in detail in chapter 4. Each location is briefly discussed in the following subsections.

3.2.1 Operable-Unit-Wide Tasks

The three tasks that are operable-unit-wide in nature are shown in a logic diagram in figure 3-2. The tasks include a hydrogeological investigation, ecological investigation, and geodetic control. Activities to be performed during the hydrogeological investigation are:

- A review of the first four rounds of available groundwater monitoring results

- A study to determine the recharge and pumping effects on the aquifer at the Richland well field

- Quarterly operable unit-wide groundwater monitoring.

Activities to be performed during the ecological investigation are:

- A land- and water-use assessment to compile and refine projections for 1100-EM-1 Operable Unit vicinity

- A well inventory to refine the information gathered during the Phase I RI.

Phase II Data Needs	Location: Operable-Unit-Wide	1100-2	UN-1100-6	Horn Rapids Landfill	Ephemeral Pool	South Pit
Contaminant Source Investigation						
Source data compilation						●
Geophysical survey				●		●
Soil gas survey			●	●		●
Surface radiation survey			●			●
Pedological Investigation			●	●	●	
Hydrogeological Investigation						
Soil gas survey				●		
Monitoring well installation		●	?	●		
Sampling and analysis	●	●	?	●		
Aquifer testing						
Groundwater monitoring interim report	●					
Groundwater elevation summary	●					
Ecological Investigation						
Land- and water-use assessment	●					
Well inventory	●					
Geodetic Control	●					

LEGEND:

● Planned task

? Contingent on results of preceeding tasks

Figure 3-1. Phase II RI Data Needs.

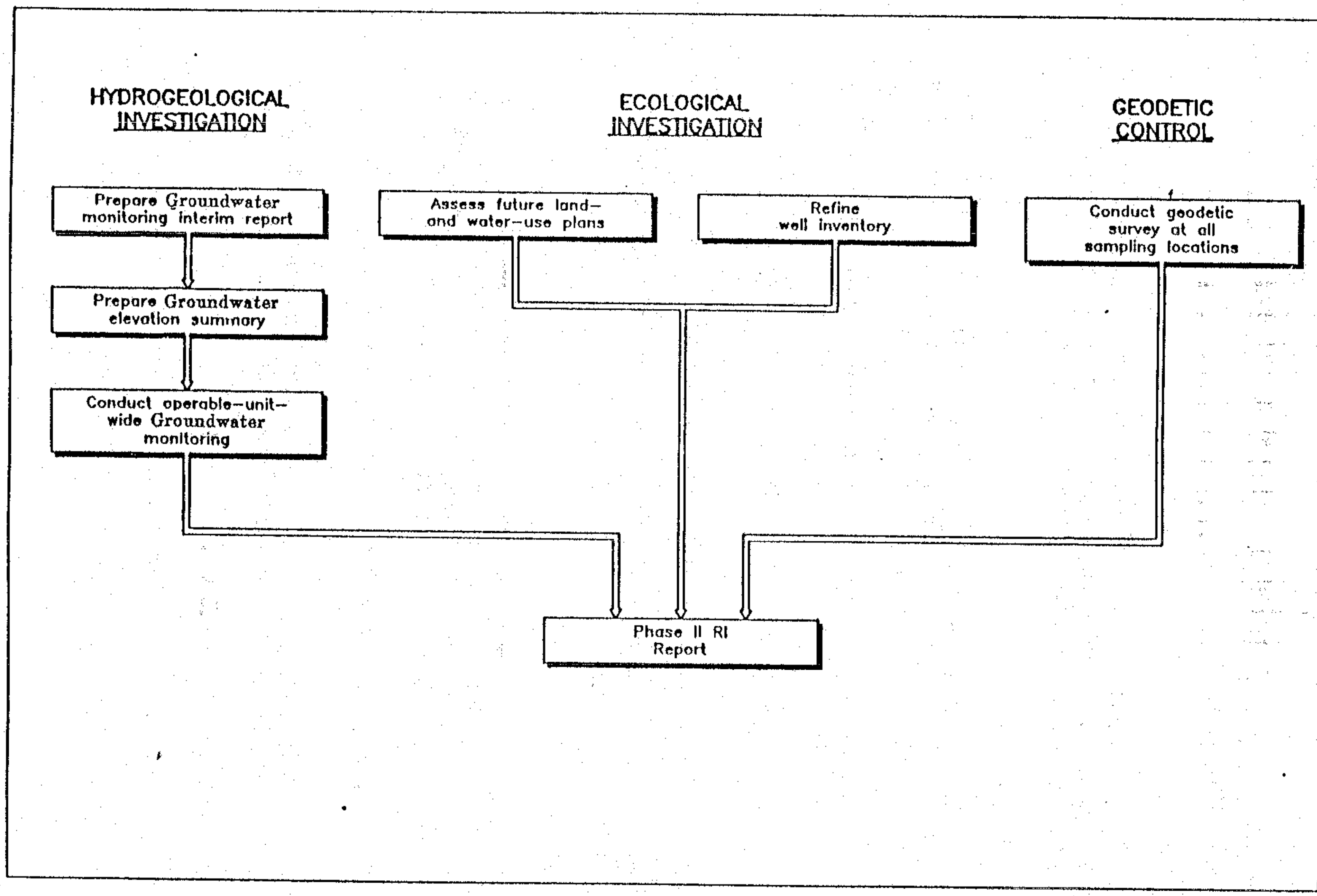

Figure 3-2. Operable-Unit-Wide Hydrogeological, and Ecological Investigations and Geodetic Control.

Geodetic control will be performed at all sampling points established for the Phase II RI to document the sampling locations.

3.2.2 1100-2 Tasks

The one task planned for the 1100-2 Paint and Solvent Pit is shown in a logic diagram in figure 3-3. The activities planned for this task are a staged monitoring well installation, sampling, and analysis to delineate the groundwater contamination attributable to the 1100-2 operable subunit.

3.2.3 UN-1100-6 Tasks

Two tasks, shown in a logic diagram in figure 3-4, are planned for the UN-1100-6 Discolored Soil Site: a contaminant source, and a hydrogeological investigation. The activities planned for the contaminant source investigation are:

- A soil gas survey to determine if a source of volatile organic compounds (VOCs) (*e.g.*, TCA) is present at the subunit

- A surface radiation survey to determine if the subunit is contaminated with radioactivity.

The activities identified for the hydrogeological investigation are contingent on the results of the source investigation and the removal action. The activities planned are staged, monitoring well installation, sampling, and analysis to delineate the groundwater contamination attributable to the operable subunit.

3.2.4 Horn Rapids Landfill Tasks

The tasks planned for the HRL are contaminant source, pedological, and hydrogeological investigations. A logic diagram for the further investigation of the HRL is shown in figure 3-5 for contaminant source and pedological investigations, and figure 3-6 for the hydrogeological investigation. The activities planned for the contaminant source investigation are:

- A geophysical survey to detect the presence of clusters of 10 or more 55-gallon drums

- Installation of a permanent soil gas monitoring network to monitor for the release of volatile organics from suspected buried drums of solvent.

Activities planned for the pedological investigation are:

- Lateral and vertical soil sampling to determine the extent of PCB contamination

- EPA-directed subsurface soil sampling in areas of known disturbance

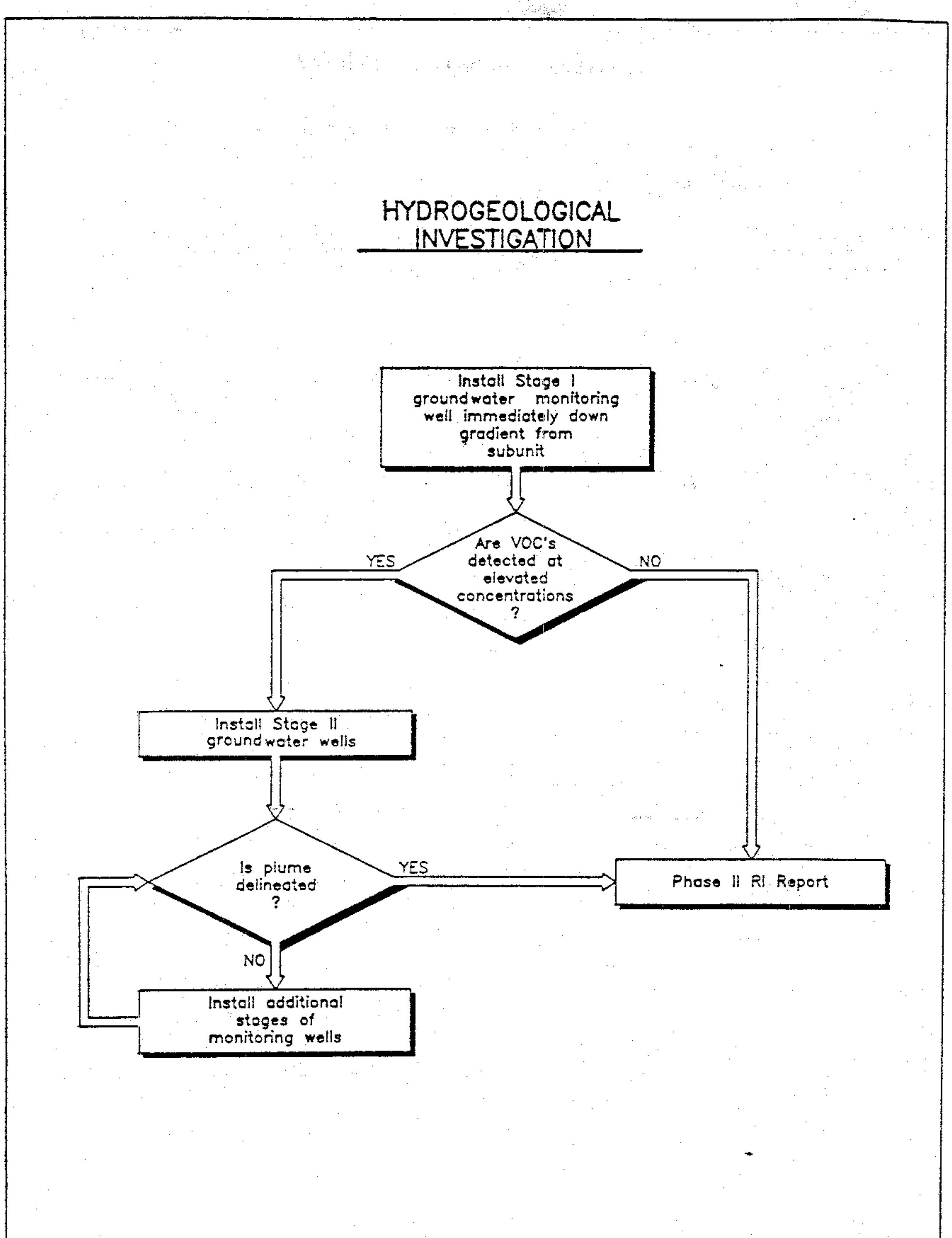

Figure 3-3. 1100-2 Operable Subunit Hydrogeological Investigation.

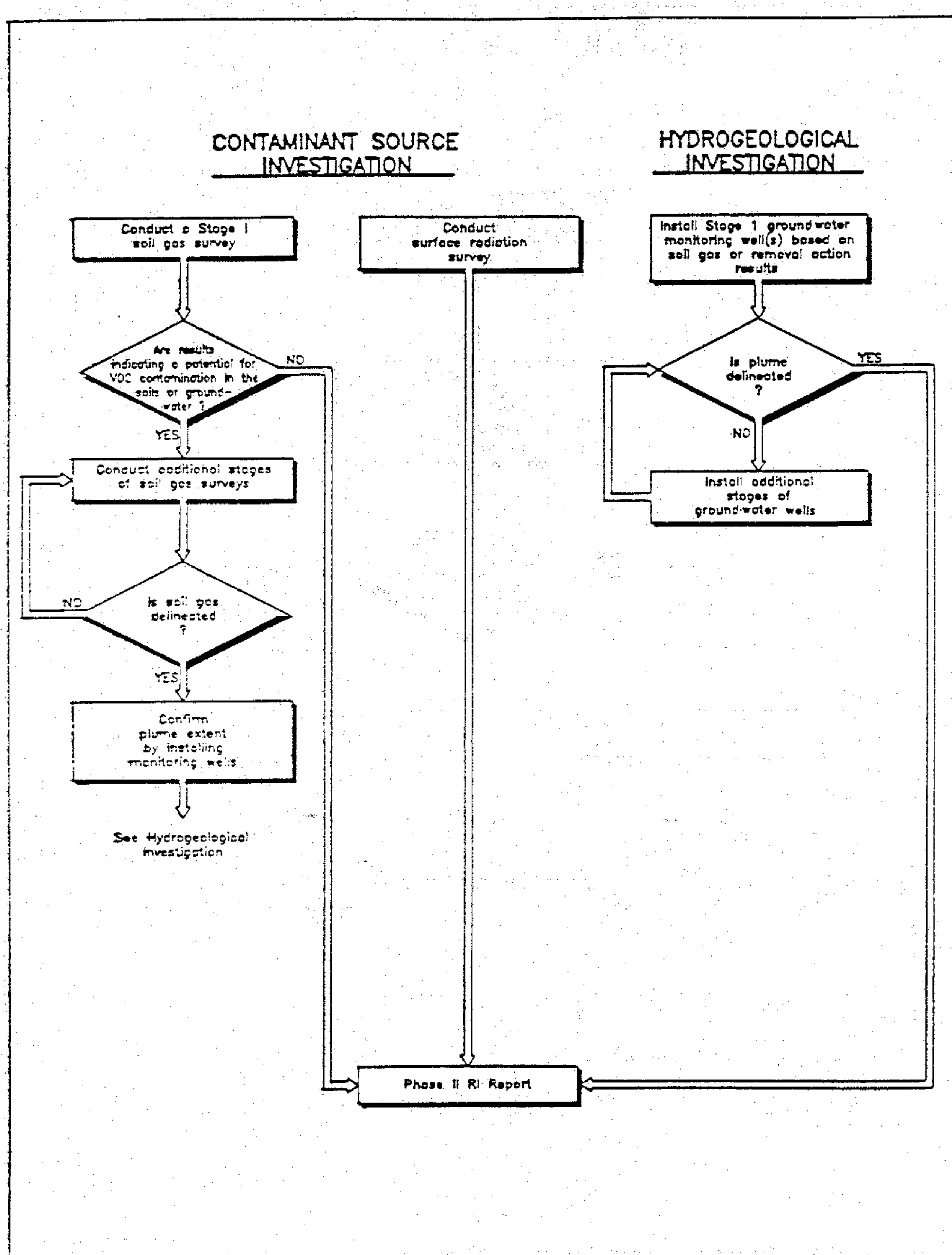

Figure 3-4. UN-1100-6 Operable Subunit Contaminant Source and Hydrogeological Investigations.

9 2 1 2 7 5 5 0 5 2 3

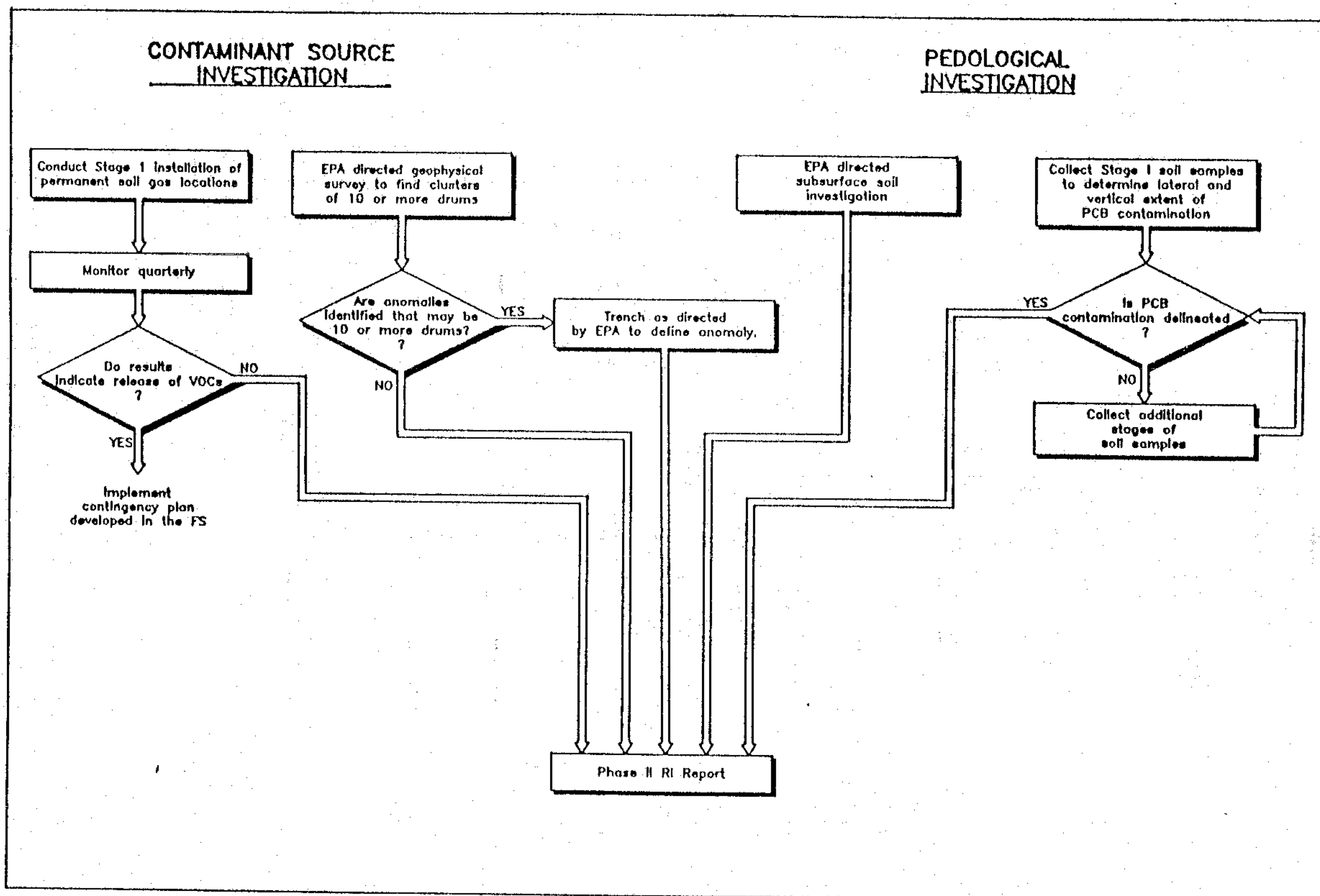

Figure 3-5. Horn Rapids Landfill Operable Subunit Contaminant Source and Pedological Investigations.

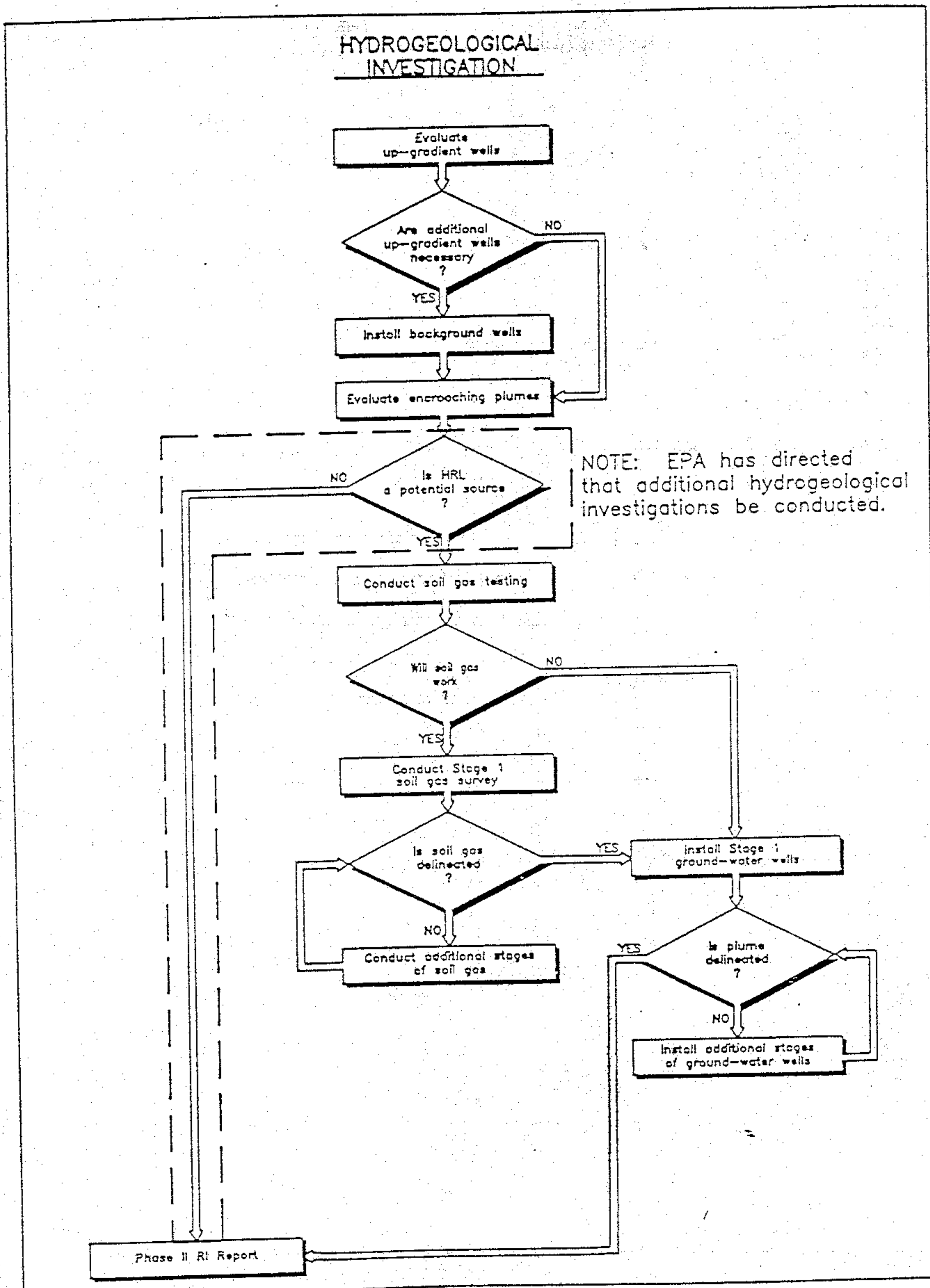

Figure 3-6. Horn Rapids Landfill Operable Subunit Hydrogeological Investigation.

9 2 1 2 7 5 5 0 5 2 5

Table 4-1. 1100-EM-1 Operable Unit Groundwater Sampling Schedule for Calendar Year 1991 (Sheet 2 of 2)

Well	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Any new Phase II wells	Complete suite	Complete suite	Complete suite	Complete suite

Complete Suite - TCL, TAL, primary and relevant secondary drinking water, WAC 173-304, and RCRA groundwater monitoring parameters.
COD - Chemical oxygen demand
NH_4 - Ammonium
SC - Specific conductance
SO_4 - Sulfate
TAL - Target analyte list
TCL - Target compound list
TDS - Total dissolved solids

4.2.2.1 Activity 2a—Land and Water Use Assessment for the 1100-EM-1 Operable Unit.

Activity Objective: The purpose of this activity is to compile any future land- and water-use projections for the Hanford Site in general, and the 1100 area and vicinity in particular for use in baseline risk assessment refinement and FS objectives.

Activity Description: Land- and water-use projections will be compiled from federal, state, and local governments having jurisdiction over the 1100 area or vicinity. These agencies will be interviewed and allowed the opportunity to review the Phase I RI report and comment on the applicable portions thereof. Project staff will obtain current drafts of documents compiled during the Phase I RI, and obtain any newly drafted materials on projected land and water use.

All information gathered under this activity will be handled according to applicable procedures referenced in table 2 of the QAPP (see appendix A).

Sample Locations, Frequencies, and Analysis: No sampling is required for this task.

4.2.2.2 Activity 2b—Well Inventory Refinement for the 1100-EM-1 Operable Unit.

Activity Objective: The purpose of this activity is to refine the information gathered during Phase I activities on groundwater withdrawal points within the potentially contaminated down gradient direction to determine if additional existing wells should be included in the Phase II RI groundwater investigation.

Activity Description: The survey will be conducted by a door-to-door search collecting information on location, current owner, current use, well condition, and well log availability. Wells will be photographed to document the current condition. Wells will also be sounded to determine the total depth and water level. Ecology files will be revisited for any new wells installed and a review will be conducted of the United States Geologic Survey (USGS) well files.

All information collected during the survey will be documented and handled in compliance with the procedures referenced in table 2 of the QAPP (see appendix A).

Sampling Locations, Frequencies, and Analysis: No sampling is required under this task. A one time survey will be conducted in Township 10 N, Range 28 E, sections 9, 10, 11, 14, 15, 16, 21, 22, 23, 26, 27, 28, and the northern half of sections 33, 34, and 35. All well locations not currently identified with north-south/east-west (NS/EW) coordinates and elevations will be surveyed (see Section 4.2.3.1).

4.2.3 Task 3—Geodetic Control for the 1100-EM-1 Operable Unit

The single activity planned for this task is geodetic surveying within the established geodetic coordinate system to determine Phase II RI sampling locations.

4.2.3.1 Activity 3a—Geodetic Survey for the 1100-EM-1 Operable Unit.

Activity Objective: The objective of this activity is to document all Phase II RI sampling point locations on an operable-unit-wide basis.

Activity Description: Location data includes NAD 1983 coordinates and elevations in feet (ft) above mean sea level (amsl). Surveys will use NAD 1983 and NGVD 1929 methods. Geodetic surveys will be conducted to third order precision (NOS 1974). Table 4-2 identifies the location data needed for specific sampling methods.

Table 4-2. Survey Data Types for Sampling Locations at the 1100-EM-1 Operable Unit

Sampling Location	Survey Data Type
Soil Gas Probes	NS/EW Coordinates
Surface Samples	NS/EW Coordinates
Soil Borings	NS/EW Coordinates and Elevations
Monitoring or Existing Wells	NS/EW Coordinates and Elevations
Geophysical Transects	NS/EW Coordinates
Surface Radiation Transects	NS/EW Coordinates

Applicable procedural controls for geodetic surveying and equipment, and field data documentation are referenced in table 2 of the QAPP (see appendix A).

Sample Locations, Frequencies and Analysis: No sampling will be conducted by this activity.

4.3 1100-2 TASKS

Elevated PCE concentrations were found within a small area of the 1100-2 operable subunit during the Phase I RI soil gas survey. Surface and subsurface soil investigations in the area of elevated soil gas concentrations did not locate a source. No monitoring wells are located immediately downgradient from this operable subunit. Further investigation is required to determine if operable subunit groundwater is contaminated. One task is planned to provide additional characterization:

- Task 1—Hydrogeological Investigation for 1100-2.

4.3.1 Task 1—Hydrogeological Investigation for 1100-2

The activities planned for this task include monitoring well installation, and groundwater sampling and analysis.

4.3.1.1 Activity 1a—Monitoring Well Installation for 1100-2.

Activity Objective: This activity will be conducted in stages. The objective of stage 1 is to install a downgradient monitoring well to monitor 1100-2 subunit groundwater. The objective of stage 2 is to delineate the extent of any significant contamination in groundwater that is attributable to the 1100-2 operable subunit.

Activity Description: One monitoring well will be installed within the upper unconfined aquifer immediately downgradient from 1100-2 operable subunit. If any contamination is present in the groundwater at significant levels and it is determined that 1100-2 is the source of the contamination, additional wells will be installed to delineate the plume. A pump test may be added if groundwater is found to be contaminated and is attributable to the 1100-2 operable subunit.

Monitoring wells will be installed according to the procedures referenced in table 2 of the QAPP (see appendix A).

Sample Location, Frequency and Analysis: The monitoring well(s) installed during this activity will be sampled by Activity 1b. The location of the Stage 1 downgradient monitoring well is shown in figure 4-2. Should additional wells become necessary, wells would be installed downgradient from the operable subunit. The effects of groundwater mounding due to the City of Richland well field operations to the east would need to be considered in locating wells, and a sufficient number of wells would need to be installed in stages to delineate the extent of the contaminant plume.

If any wells are installed during this activity, soil samples will be obtained every 1.5 m (5 ft) and at changes of lithology in the unsaturated zone, from a maximum of four additional monitoring wells. Samples will be obtained by drive tube, sealed, and analyzed, according to procedures referenced in table 2 of the QAPP (see appendix A), for in-situ moisture. No new background wells would need to be constructed. Existing background well locations that are known to be unimpacted by releases from the SNP complex, and are thus appropriate for comparisons, are shown in figure 4-3. All monitoring wells installed under this activity will be geodetically surveyed (see Section 4.2.3.1).

4.3.1.2 Activity 1b—Groundwater Sampling and Analysis for 1100-2.

Activity Objective: The objective of this task is to sample and analyze groundwater monitoring well(s) installed during Activity 1a.

Activity Description: Groundwater samples will be obtained from the stage 1 downgradient monitoring well, and analyzed to characterize the operable subunit groundwater. Analytical results will also be used to determine if additional stages of monitoring well installation are required to delineate operable subunit groundwater contamination.

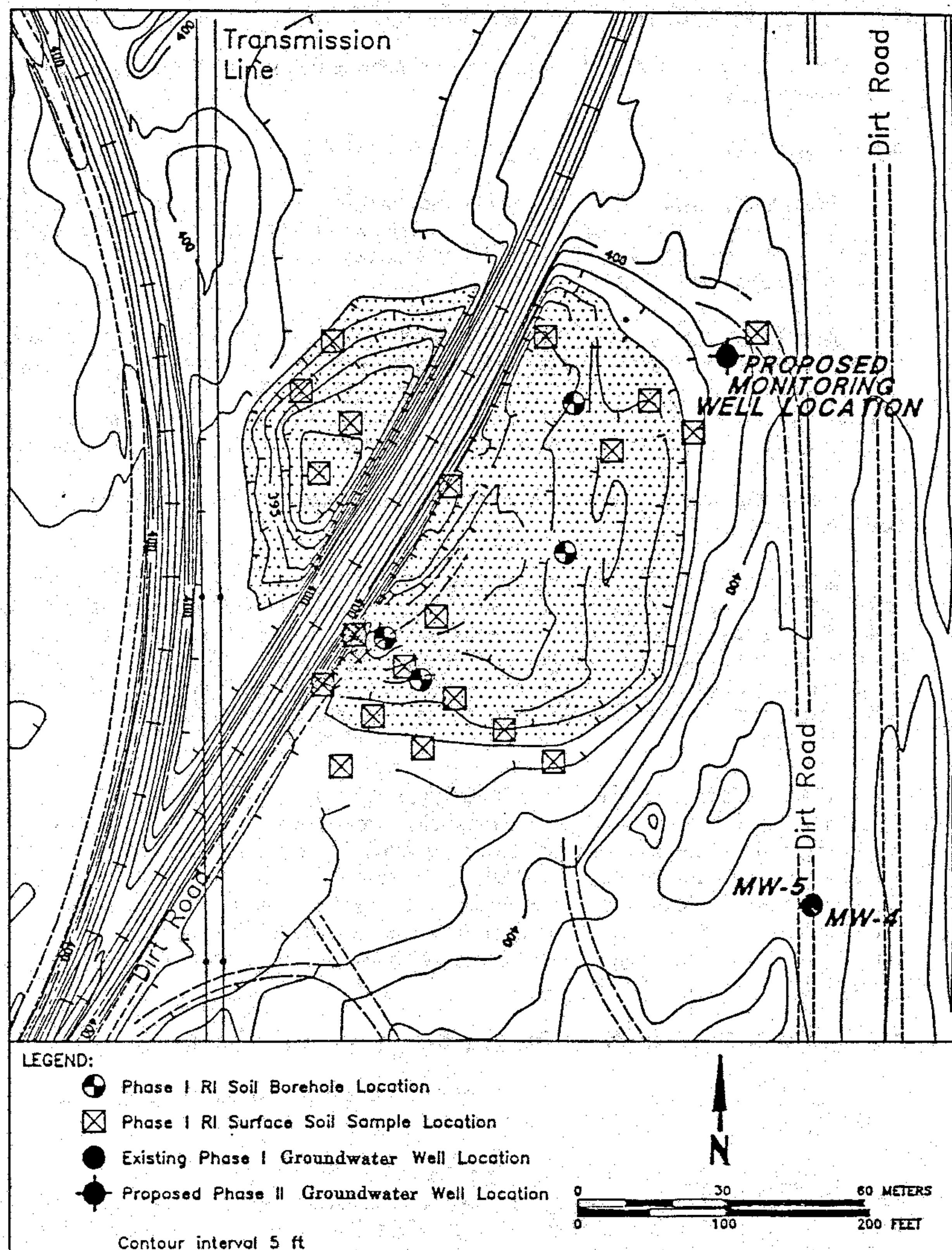

Figure 4-2. Proposed Location for the Stage 1 Phase II RI Monitoring Well for the 1100-2 Operable Subunit.

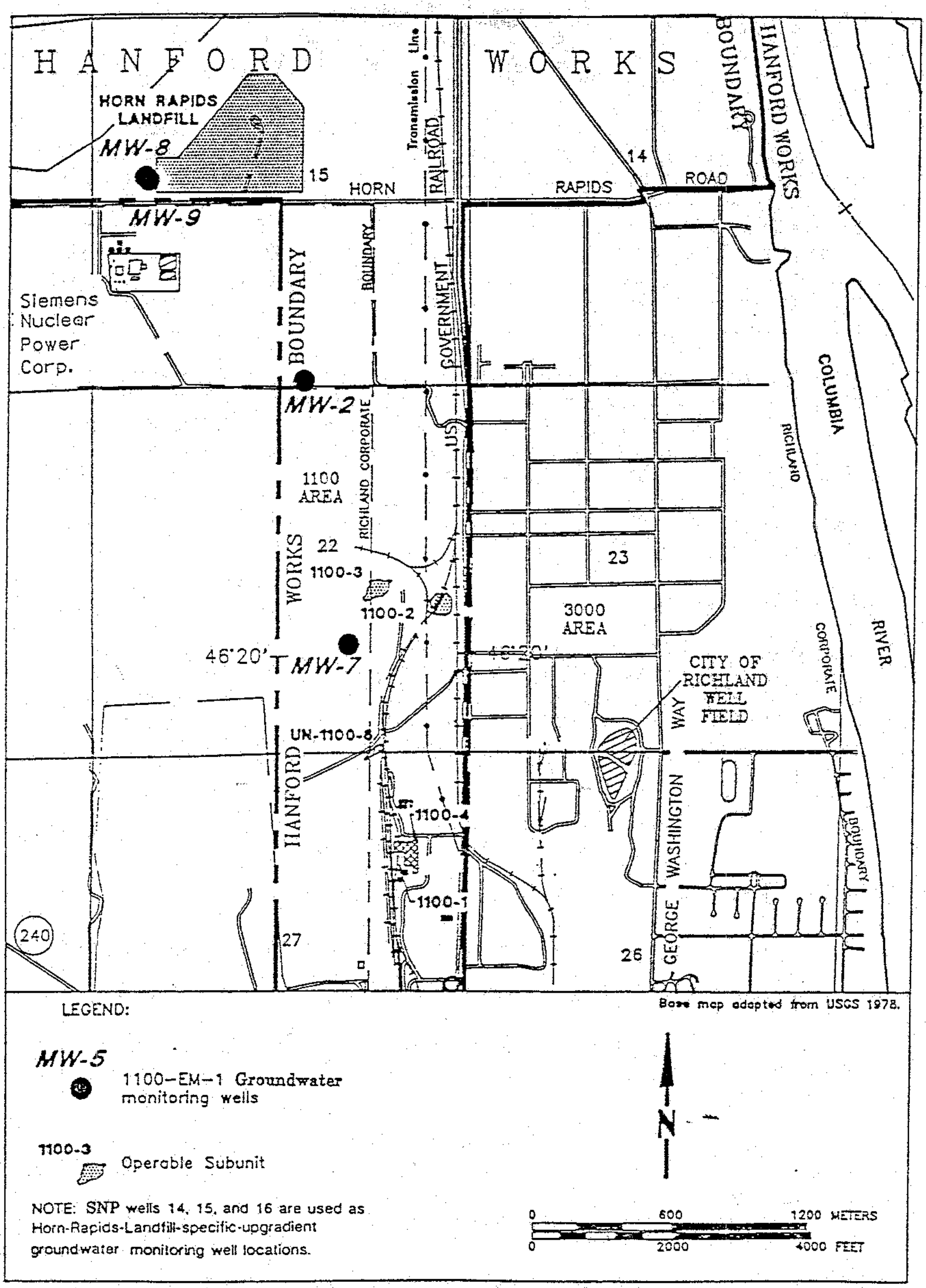

Figure 4-3. Operable-Unit-Specific-Upgradient Groundwater Monitoring Well Locations.

9 2 1 2 7) 5 0 5 4 1

Sampling equipment, sample designation, and handling procedures are referenced in chapters 4 and 5 and table 2 of the QAPP (see appendix A).

Sample Location, Frequency and Analysis: Groundwater will be sampled from the Stage 1 downgradient well, installed under Activity 1a, within one week after well completion, then quarterly for two periods, and finally included, as necessary, in the regular monitoring for the operable unit. The Stage 1 initial two rounds of sampling (the second round is required for verification of the results from the first round) will be analyzed for TCL, TAL, primary and relevant secondary drinking water, and Washington Administrative Code (WAC) 173-304 and RCRA groundwater monitoring parameters according to the analytical procedures referenced in table 1 of the QAPP (see appendix A).

Additional rounds of sampling will be analyzed for contaminants of interest. Such parameters will be determined from the results of the Data Evaluation and Baseline Risk Assessment Refinement Tasks (see Sections 4.9.3 and 4.12, respectively). The list of contaminants of interest will be developed from the results of the two initial rounds of sampling. If Stage 2 monitoring wells are installed, samples will be taken within one week of well completion, then quarterly for two periods, and finally included in the regular monitoring for the operable unit. Stage 2 samples will be analyzed for the contaminants of interest determined after the first two rounds of sampling in the Stage 1 well.

4.4 UN-1100-6 TASKS

Only surface soils were sampled and analyzed during Phase I RI activities. Further characterization of the UN-1100-6 operable subunit is required due to the elevated BEHP contamination and the low levels of VOCs in the surface soils. The BEHP concentrations in the surface soils of this subunit pose potentially significant risks to human health under current land- and water-use conditions. Some additional characterization of this subunit is described in the following tasks:

- Task 1—Contaminant Source Investigation for UN-1100-6
- Task 2—Hydrogeological Investigation for UN-1100-6.

4.4.1 Task 1—Contaminant Source Investigation for UN-1100-6

A soil gas survey and a surface radiation survey are the two activities under this task.

4.4.1.1 Activity 1a—Soil Gas Survey for UN-1100-6.

Activity Objective: The purpose of this activity is to determine if a source of the low levels of VOCs found in the surface soils is present in the vadose zone or groundwater at the UN-1100-6 operable subunit.

Activity Description: A soil gas survey will be conducted to determine if a source of VOC contamination exists in the vadose zone at the UN-1100-6 operable subunit. If additional stages of soil gas surveys are required to delineate any significant VOC contamination, an activity will be created under Task 3, Hydrogeological Investigation.

Soil gas probe installation, sampling, sample handling, and sample designation procedures are referenced in table 2 of the QAPP (see appendix A).

Sample Location, Frequency and Analysis: Nine temporary soil gas probes will be installed to a depth of 1.2 m (4 ft) at locations shown in figure 4-4. Once probes are installed, soil gas will be sampled and analyzed one time. Soil gas will be analyzed for the VOCs referenced in table 1 of the QAPP (see appendix A) by the methods which are specified therein. Soil gas probe locations will be staked to allow for geodetic surveying (see Section 4.2.3.1).

4.4.1.2 Activity 1b—Surface Radiation Survey for UN-1100-6.

Activity Objective: The purpose of this activity is to determine whether the surface soils of the UN-1100-6 operable subunit are contaminated.

Activity Description: An operable unit-specific background plot will first be established by conducting the survey on land surfaces where operable unit background soils were obtained. The surface of the operable subunit will be surveyed for alpha-, beta-, and gamma-radiation.

Procedures for conducting the surface radiation survey are referenced in table 2 of the QAPP (see appendix A).

Sample Locations, Frequency and Analysis: The background plots established for the operable unit will be used for determining background surface radiation levels at the UN-1100-6 operable subunit. This background radiation survey will be conducted in the areas of the three background soil sampling locations established during the Phase I RI (see figure 4-5) to the west of the operable unit. The three background plots will be approximately 23 m (75 ft) by 23 m (75 ft). Sampling at the background plots will be conducted at intersecting points on approximately an 8-m (25-ft) grid to obtain discrete readings at each point. This grid spacing may be modified if it is determined that a closer spacing is required. Approximately 48 total points will be sampled using this grid spacing. Such background measurements will be obtained after the operable subunit itself is surveyed, and only if detectable levels of radiation are encountered.

Sampling within the UN-1100-6 operable subunit will be conducted along transects within the area shown in figure 4-6 at approximately 8-m (25-ft) intervals to determine the location and the extent of elevated radiation. This grid spacing may be modified if it is determined that a closer spacing is required. Where an elevated level of radiation (statistically greater than background) is encountered along a transect, the survey will depart from the transect to locate and quantify the source of the reading. Areas with elevated radiation will be staked and flagged for subsequent geodetic surveying (see Section 4.2.3.1).

The surface radiation survey will be conducted for alpha-, beta-, and gamma-radiation using a hand-held, laboratory-quality, alpha detector and a sodium-iodide, beta/gamma detector that reads in counts per minute. The survey will be done in dry weather conditions to avoid the potential for water shielding of alpha and lower energy beta sources.

Continuous recording equipment will be used to generate data along the grid lines during the surface radiation survey. Records of all calibrations and procedure applications will be maintained in a field notebook in accordance with procedures referenced in table 2 of the QAPP (see appendix A).

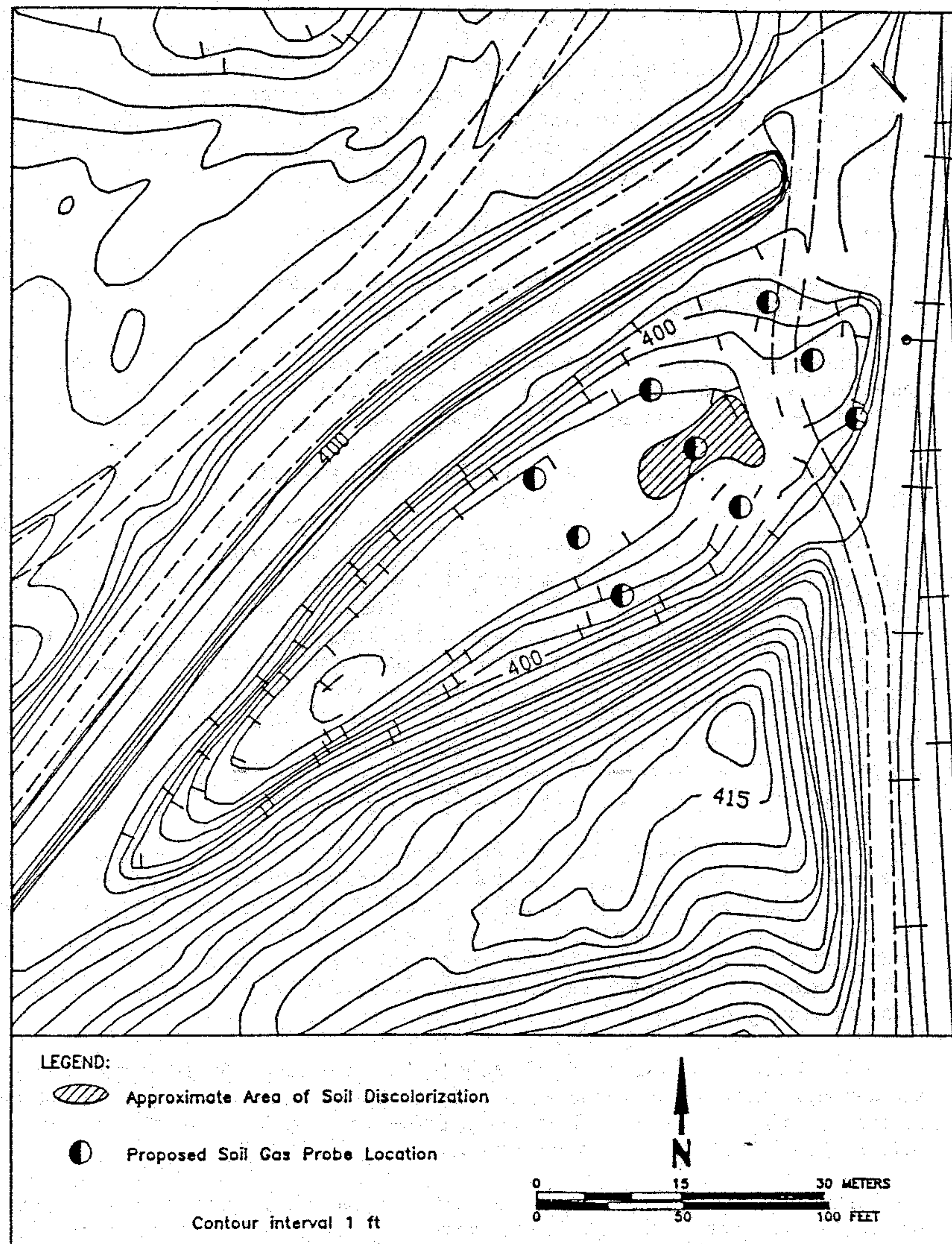

Figure 4-4. Proposed Locations for the Phase II RI Soil Gas Probes for the UN-1100-6 Operable Subunit.

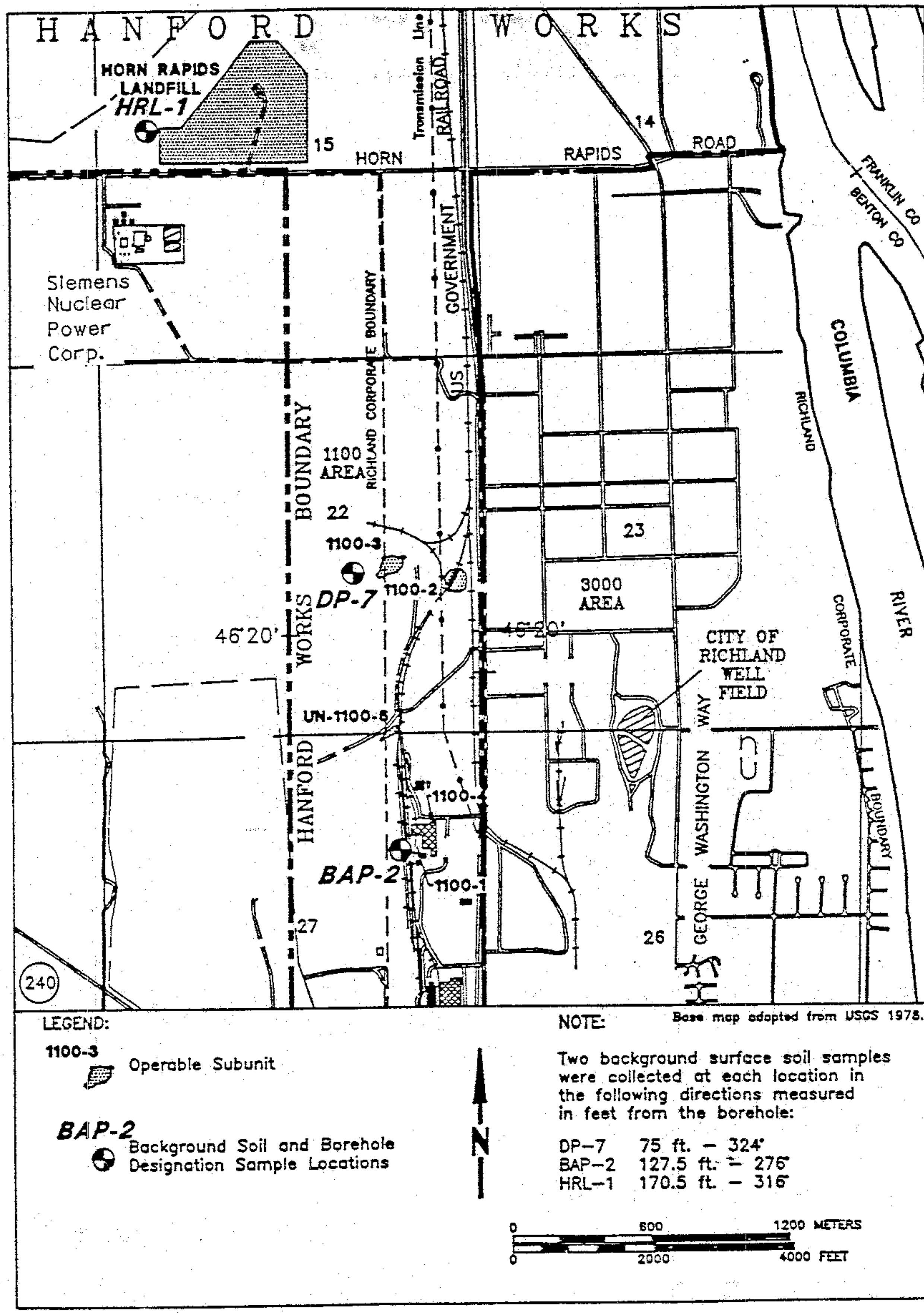

Figure 4-5. Background Soil Sampling Locations for the 1100-EM-1 Operable Unit.

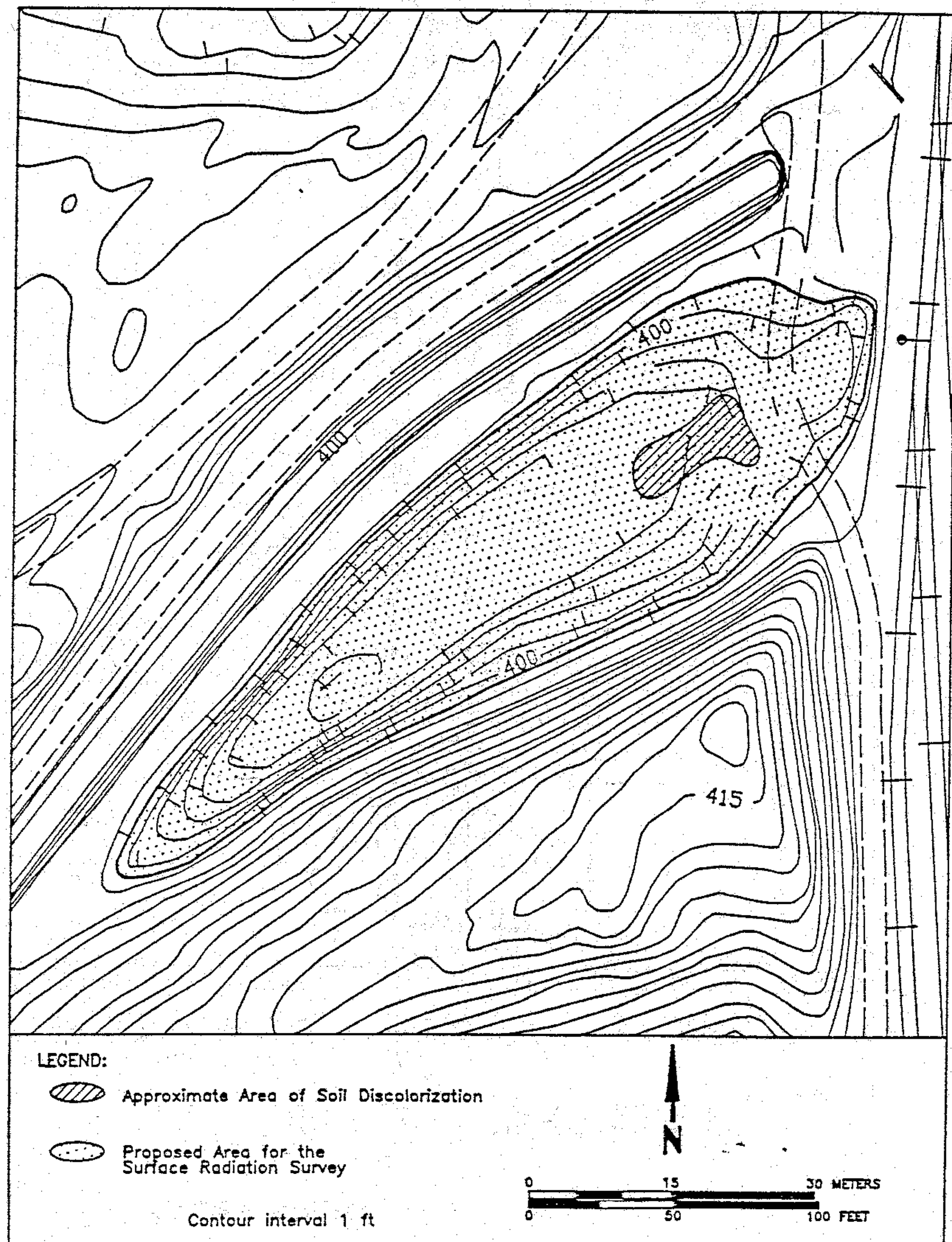

Figure 4-6. Proposed Area to Conduct the Surface Radiation Survey at UN-1100-6 Operable Subunit.

4.4.2 Task 2—Hydrogeological Investigation for UN-1100-6

The need for the implementation of this task is contingent on the results of the soil gas survey (see Section 4.4.1.1) and the vertical extent of BEHP as determined by the proposed removal action. If the UN-1100-6 is not found to be a source of potential VOC groundwater contamination, or the BEHP contamination is limited to surface soils, no further hydrogeological characterization will be conducted.

This task is further divided into two activities: monitoring well installation and groundwater sampling and analysis.

4.4.2.1 Activity 3a—Monitoring Well Installation at UN-1100-6.

Activity Objective: The objective of this activity is to delineate the extent of any significant VOC and SVOC contamination in groundwater that is attributed to the UN-1100-6 operable subunit.

Activity Description: Monitoring wells will be installed in stages. Stage 1 monitoring well installation will consist of installing one monitoring well immediately downgradient from the UN-1100-6 operable subunit. If the groundwater is contaminated, additional stages of monitoring wells will be installed to delineate the plume.

Monitoring well installation procedures are referenced in table 2 of the QAPP (see appendix A).

Sample Location, Frequency and Analysis: Should this task become necessary, the Stage 1 monitoring well will be installed immediately downgradient from the operable subunit as shown in figure 4-7. If required, a sufficient number of wells would need to be installed in stages to delineate the extent of the contamination. If any monitoring wells are installed during this activity, soil samples will be obtained every 1.5 m (5 ft) and at changes of lithology in the unsaturated zone at a maximum of four additional monitoring wells. Samples will be obtained by drive tube, sealed, and analyzed according to procedures referenced in table 2 of the QAPP (see appendix A) for in-situ moisture. The effects of groundwater mounding due to City of Richland well field operations to the east would need to be considered in locating wells. No new background wells would need to be constructed. All wells installed by this task will be geodetically surveyed (see Section 4.2.3.1).

4.4.2.2 Activity 3b—Groundwater Sampling and Analysis at UN-1100-6.

Activity Objective: The purpose of this activity is to sample and analyze the groundwater monitoring wells installed during Activity 3a (see Section 4.4.2.1).

Activity Description: Groundwater samples will be obtained from the Stage 1 downgradient well, and analyzed to characterize operable unit groundwater. Analytical results will be used to determine if additional stages of monitoring wells are required to delineate operable subunit groundwater contamination.

Sampling equipment, sample designation, and handling procedures are referenced in chapters 4 and 5 and table 2 of the QAPP (see appendix A).

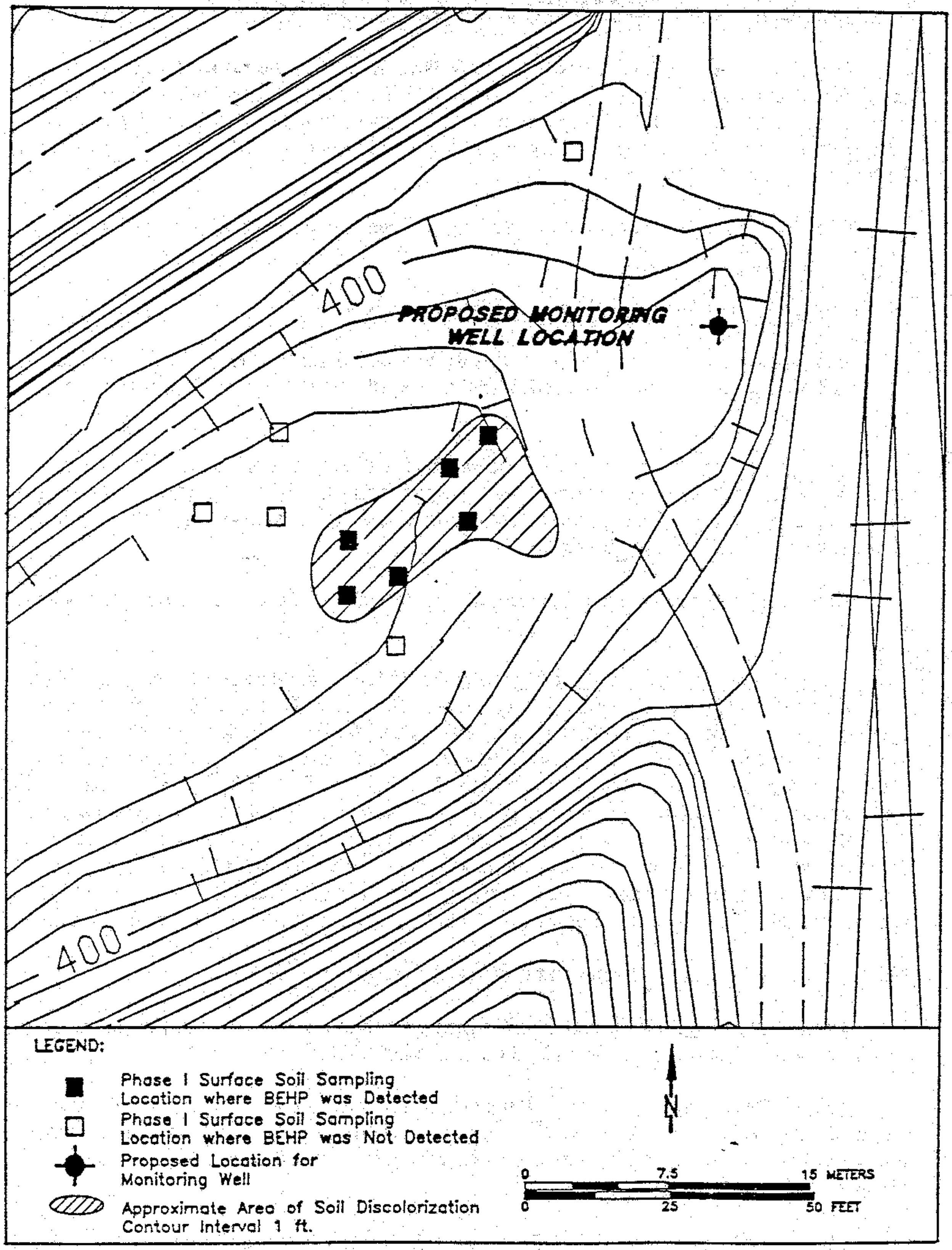

Figure 4-7. Proposed Location of the Contingent Stage 1 Ground-Water Monitoring Well at the UN-1100-6 Operable Subunit.

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APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

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GLOSSARY

Accuracy: Accuracy may be interpreted as the measure of the bias in a system. Sampling accuracy is normally assessed through the evaluation of matrix spiked samples and reference samples.

Audit: Audits in environmental investigations are considered to be systematic checks to verify the quality of operation of one or more elements of the total measurement system. In this sense, audits may be of two types: (1) performance audits, in which quantitative data are independently obtained for comparison with data routinely obtained in a measurement system, or (2) system audits, involving a qualitative onsite evaluation of laboratories or other organizational elements of the measurement system for compliance with established quality assurance program and procedure requirements.

Blind sample: A blind sample refers to any type of sample routed to the primary laboratory for purposes of auditing performance relative to a particular sample matrix and analytical method. Blind samples are not specifically identified as such to the laboratory; they may be made from traceable standards or may consist of sample material spiked with a known concentration of a known compound.

Comparability: Comparability is an expression of the relative confidence with which one data set may be compared with another.

Completeness: Completeness is the measure of the amount of valid data actually obtained against the amount expected under normal correct conditions.

Confidence interval: Confidence intervals are applied to bound the value of a population parameter within a specified degree of confidence (i.e., the confidence coefficient), usually 90%, 95%, or 99%. The form of a confidence interval depends on the underlying assumptions and intentions. It assumes different values for different random samples and requires specification of the number of observations on which the interval is based.

Deviation: For the purpose of environmental investigations, deviation refers to a planned departure from established criteria that may be required as a result of unforeseen field situations or that may be required to correct ambiguities in procedures that may arise in practical applications.

Equipment blanks: Equipment blanks consist of organic-free deionized, distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples; they are used to verify the adequacy of sampling equipment decontamination procedures and are normally collected at the same frequency as field duplicate samples.

Field blanks: Field blanks consist of organic-free deionized, distilled water, transferred to a sample container at the site and preserved with the reagent specified for the analytes of interest; they are used to check for possible contamination originating with the reagent or the sampling environment and are normally collected at the same frequency as field duplicate samples.

Field duplicate sample: Field duplicate samples are samples retrieved from the same sampling location using the same equipment and sampling technique, placed in separate identically prepared and preserved containers, and analyzed independently. Field duplicate samples are generally used to verify the repeatability or reproducibility of analytical data and are normally analyzed with each analytical batch or every 20 samples, whichever is greater.

Matrix spiked samples: Matrix spiked samples are a type of laboratory quality control sample; they are prepared by splitting a sample received from the field into two homogenous aliquots (i.e., replicate samples) and adding a known quantity of a representative analyte of interest to one aliquot to calculate percentage of recovery.

Nonconformance: A nonconformance is a deficiency in characteristic, documentation, or procedure that renders the quality of material, equipment, services, or activities unacceptable or indeterminate. When the deficiency is of a minor nature, does not effect a permanent or significant change in quality if it is not corrected, and can be brought into conformance with immediate corrective action, it shall not be categorized as a nonconformance. However, if the nature of the condition is such that it cannot be immediately and satisfactorily corrected, it shall be documented in compliance with approved procedures and brought to the attention of management for disposition and appropriate corrective action.

Precision: Precision is a measure of the repeatability or reproducibility of specific measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. Precision is normally expressed in terms of standard deviation, but may also be expressed as the coefficient of variation (i.e., relative standard deviation) and range (i.e., maximum value minus minimum value). Precision is assessed by means of duplicate/replicate sample analysis.

Quality assurance: Quality assurance refers to the total integrated quality planning, quality control, quality assessment, and corrective action activities that collectively ensure that the data from monitoring and analysis meet all end user requirements and/or the intended end use of the data.

Quality Assurance Program Plan: The Quality Assurance program plan is an orderly assemblage of management policies, objectives, principles, and general procedures by which an agency or laboratory outlines how it intends to produce data of known and accepted quality.

Quality Assurance Project Plan: The Quality Assurance project plan is an orderly assemblage of management policies, project objectives, methods, and procedures that defines how data of known quality will be produced for a particular project or investigation.

Quality control: Quality control refers to the routine application of procedures and defined methods to the performance of sampling, measurement, and analytical processes.

Reference samples: Reference samples are a type of laboratory quality control sample prepared from an independent, traceable standard at a concentration other than that used for analytical equipment calibration, but within the calibration range. Such reference samples are required for every analytical batch or every 20 samples, whichever is greater.

Replicate sample: Replicate samples are two aliquots removed from the same sample container in the laboratory and analyzed independently.

Representativeness: Representativeness is the degree to which data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of a sampling program.

Split sample: A split sample is produced through homogenizing a field sample and separating the sample material into two equal aliquots. Field split samples are usually routed to separate laboratories for independent analysis, generally for purposes of auditing the performance of the primary laboratory relative to a particular sample matrix and analytical method. See the glossary entry for Audit. In the laboratory, samples are generally split to create matrix spiked samples; see the glossary entry for matrixed spike samples, above.

Trip blanks: Trip blanks are a type of field quality control sample, consisting of pure deionized, distilled water in a clean, sealed sample container, accompanying each batch of containers shipped to the sampling site and returned unopened to the laboratory. Trip blanks are used to identify any possible contamination originating from container preparation methods, shipment, handling, storage, or site conditions.

Validation: Validation is a systematic process of reviewing a body of data against a set of criteria to provide assurance that the data are acceptable for their intended use. Validation methods may include review of verification activities, screening, cross-checking, or technical review.

Verification: Verification is the process of determining whether procedures, processes, data, or documentation conform to specified requirements. Verification activities may include inspections, audits, surveillances, or technical review.

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CONTENTS

CONTENTS (cont.)

FIGURES

TABLES

1.0 PROJECT DESCRIPTION

1.1 PROJECT OBJECTIVE

The primary objective of the Phase II Remedial Investigation (RI) for the 1100-EM-1 operable unit is to further define the extent and location of sources of radioactive, inorganic, and other types of contaminants in the vadose zone and groundwater. Data resulting from this investigation will be evaluated to determine the most feasible options for treatability investigations, remediation, or closure.

1.2 BACKGROUND INFORMATION

The 1100-EM-1 Operable Unit is located partially outside the boundary at the Hanford Site, near its southeastern corner, as shown on Figure 1. Detailed background information regarding the history and present use of the unit is provided in Chapter 2.0 of the Phase I RI report (DOE-RL 1990); results of Phase I activities are also discussed in detail in the Phase I RI report.

1.3 QUALITY ASSURANCE PROJECT PLAN SCOPE AND RELATIONSHIP TO WESTINGHOUSE HANFORD QUALITY ASSURANCE PROGRAM

This Quality Assurance project plan (QAPP) is designed to support the supplemental work plan for the Phase II characterization of the 1100-EM-1 Operable Unit. It is prepared in compliance with the Westinghouse Hanford Company (Westinghouse Hanford) *Quality Assurance Program Plan for Comprehensive Environmental Response, Compensation, and Liability Act Remedial Investigation/Feasibility Study Activities, WHC-SP-0447* (WHC 1989a), which describes implementation of the overall quality assurance (QA) program requirements defined by the *Westinghouse Hanford Company Quality Assurance Manual, WHC-CM-4-2* (WHC 1989b), as applicable to *Comprehensive Environmental Response Compensation, and Liability Act of 1980* (CERCLA) remedial investigation/feasibility study (RI/FS) environmental investigations. WHC-SP-0447 (WHC 1990a) accommodates the specific requirements for project plan format and content agreed upon in the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1990), and contains a matrix of procedural resources (from WHC-CM-4-2 [WHC 1989b] and from the *Westinghouse Hanford Environmental Investigations and Site Characterization Manual,* WHC-CM-7-7 [WHC 1989c]) that have been selected to support this QAPP. Distribution and revision control shall be performed in compliance with quality requirement (QR) 6.0, "Document Control" from WHC-CM-4-2 (WHC 1989b). Interim changes to this QAPP or the supplemental work plan shall be documented, reviewed, and approved as required by Section 6.6 of Environmental Investigation Instruction (EII) 1.9, "Work Plan Review" (WHC 1989c), and shall be documented in monthly unit managers' meeting minutes. The distribution of the QAPP beyond that indicated by Section 6.5 of EII 1.9 shall be defined by the Westinghouse Hanford project coordinator. All other plans or procedures referenced in the QAPP and shall be made available for regulatory review upon request, at the direction of the project coordinator.

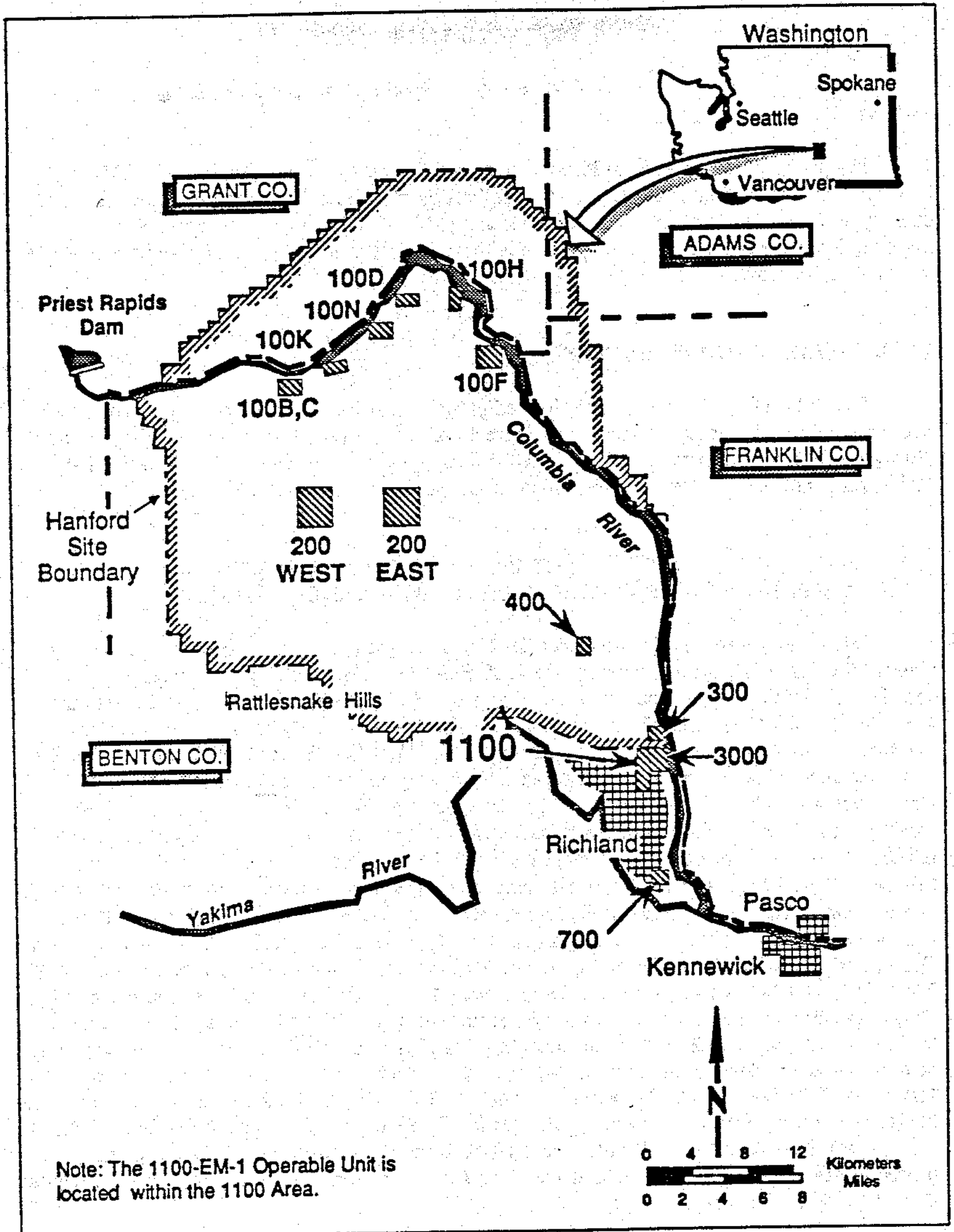

Figure 1. The Location of the 1100 Area at the Hanford Site

1.4 TASK DESCRIPTIONS

The Phase II investigations at 1100-EM-1 are subdivided into thirteen individual tasks and a number of activities; individual task scopes are described in detail in Chapter 4.0 of the supplemental work plan, Sections 4.2 through 4.13. Procedures applicable to the tasks described therein are identified in Chapter 4.0 and Table 2 of this QAPP.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 PROJECT COORDINATOR RESPONSIBILITIES

The Environmental Engineering and Technology function of Westinghouse Hanford has primary responsibilities for coordinating the performance of this investigation until passed to the U.S. Army Corps of Engineers, Walla Walla District in October 1991. Organizational charts are included in the Project Management Plan (PMP) provided in Chapter 3.0 of the Phase I work plan (DOE-RL 88-23) that define personnel assignments and individual Westinghouse Hanford Field Team structures applicable to the types of tasks included in this phase of the investigation.

External participant contractors or subcontractors may be evaluated and selected for certain portions of task activities at the direction of the project coordinator, in compliance with Westinghouse Hanford procedures Quality Requirement (QR) 4.0, "Procurement Document Control"; Quality Instruction (QI) 4.1, "Procurement Document Control"; QI 4.2, "External Service Control"; QR 7.0, "Control of Purchased Items and Services"; QI 7.1, "Procurement Planning and Control"; and QI 7.2, "Supplier Evaluation (WHC 1989b). The primary participant contractor and subcontractor resources for the Hanford Site are listed in Figure 3-2 of the PMP (DOE-RL 88-23).

2.2 ANALYTICAL LABORATORIES

The Westinghouse Hanford field sampling team will be responsible for screening all samples for radioactivity and separating samples into two groups for further analysis. Samples with levels of radioactivity exceeding background, as detected by standard field survey equipment, will normally be routed to a Westinghouse Hanford or Hanford Site participant contractor laboratory that is equipped and qualified to analyze radioactive samples. Samples exhibiting levels of radioactivity exceeding background will not be released to an offsite laboratory based on field measurements, but shall be routed to an appropriate laboratory, measured with laboratory radioanalytical equipment, and then released in accordance with Westinghouse Hanford-approved procedures. All analyses shall be coordinated through the Westinghouse Hanford Office of Sample Management (OSM) and shall be performed in compliance with Westinghouse Hanford-approved laboratory QA plans and analytical procedures. The surveillance controls invoked by QI 7.3, "Source Surveillance and Inspection" (WHC 1989b) are applicable to all offsite laboratory operations; QI 10.4, "Surveillances" (WHC 1989b) applies onsite. Applicable quality requirements for subcontractors or participant contractors shall be invoked as part of the approved procurement documentation or work order as noted in Section 4.1.2. Services of alternate qualified laboratories may be procured for radioactive sample analysis, if onsite laboratory capacity is not available, and for the performance of split (performance audit) sample analysis at the Westinghouse Hanford project coordinator's direction. If such alternate laboratory services are required, the laboratory QA plan and applicable analytical procedures shall be approved by Westinghouse Hanford before they are used.

2.3 OTHER SUPPORT CONTRACTORS

Procurements of all contracted field activities shall be in compliance with standard Westinghouse procurement procedures as discussed in Sections 2.1 and 4.2. All work shall be performed in compliance with Westinghouse Hanford-approved QA plans and/or procedures, subject to surveillance controls invoked by QI 7.3, "Source Surveillance and Inspection" for offsite work, or by QI 10.4 "Surveillances" (WHC 1989b) for onsite work. Applicable quality requirements shall be invoked as part of the approved procurement documentation or work order.

3.0 QUALITY ASSURANCE REQUIREMENTS FOR MEASUREMENTS

Additional analytical data from soil and groundwater sampling activities will be obtained during the Phase II RI at 1100-EM-1; these data shall be evaluated to further characterize the extent and nature of radioactive and hazardous contamination and to determine the most feasible options for corrective measures. In compliance with the guidelines provided in *A Proposed Data Quality Strategy for Hanford Site Characterization* (McCain and Johnson 1990) (which interprets applicable portions of *Data Quality Objectives for Remedial Responses Activities; Volume 1 Development Process* (EPA 1987) for use at the Hanford Site), two general types of analysis will be performed: (1) rapid response screening analysis; and (2) confirmatory analyses with documentation appropriate to analytical levels described in the 1100-EM-1 Phase I work plan (DOE-RL 88-23).

Screening analyses may involve both field or laboratory methods. Laboratory methods used for screening purposes may be identical or similar to those later used for confirmatory analysis, but with less rigorous method-specific QA/QC requirements, documentation requirements, and validation requirements. As a consequence, screening methods are characterized by quick turnaround times and lower costs; however, they may not be compound-specific, and the data may be qualitative or only semiquantitative. Data from screening analyses must be verified in compliance with Section 8.2.1 before use in focusing subsequent, more detailed stages of the sampling investigation. For Phase II investigations at 1100-EM-1, screening analyses will be confined to surface-based radiation surveys and soil gas surveys using field methods, the results of which will be used to guide more detailed sampling and laboratory-based analytical investigations for radioactive and hazardous contaminants. All screening methods will be subject to review and approval by Westinghouse Hanford prior to use.

Fully validated analyses will employ standard EPA reference methods, other standard reference methods, or other methods developed or modified specifically to meet the needs of the Hanford Site. All such analyses shall be documented in compliance with Section 8.1 and validated in compliance with sections 8.2.2 and 8.2.3, as appropriate for the method concerned. For Phase II investigations at 1100-EM-1, such analyses will be performed using standard EPA reference methods as noted in Table 1. Table 1 identifies target values for detection limits, precision, and accuracy that must be adjusted and/or confirmed and accepted by Westinghouse Hanford and the proposed laboratory before final approval of associated subcontracts or work orders. Once these values are established as contractual requirements in compliance with standard procurement procedures (see Section 4.1), Table 1 shall be updated to reference approved detection limit, precision, and accuracy criteria as project requirements; all such changes shall be documented in monthly unit managers' meeting minutes as required by Section 6.6 of EII 1.9, "Work Plan Review" (WHC 1989c).

Goals for data representativeness are addressed qualitatively by the specification of sampling locations and intervals within the Chapter 4.0 and Figures 4-1 through 4-17 of the supplemental work plan. Objectives for completeness for this investigation shall require that contractually or procedurally established requirements for precision and accuracy be met for at least 90% of the total number of requested determinations. Failure to meet this criterion shall be evaluated in the data assessment process described in Chapter 12.0, and shall be subject to any necessary corrective action as discussed in Chapter 13.0. Approved analytical procedures shall require the use of reporting techniques and units specified in the EPA reference methods in Table 1 to facilitate the comparability of data sets in terms of precision and accuracy.

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4.0 SAMPLING PROCEDURES

4.1 PROCEDURE APPROVALS AND CONTROL

4.1.1 Westinghouse Hanford Procedures

The Westinghouse Hanford procedures cited in this QAPP have been selected from the Quality Assurance Program Index included in the WHC-SP-0447 (WHC 1989a). Selected procedures include EIIs from the *Environmental Investigations and Site Characterization Manual* (WHC 1989c), QRs and QIs from the *Westinghouse Hanford Company Quality Assurance Manual* (WHC 1989b), and procedures from the *Operational Health Physics Practices Manual* (WHC 1988). All procedures are listed in Table 2, cross referenced to individual subunit investigations by applicability. Procedure approval, revision, and distribution control requirements applicable to EIIs are addressed in EII 1.2, "Preparation and Revision of Environmental Investigations Instructions" (WHC 1989c); requirements applicable to QIs and QRs are addressed in QR 5.0, "Instructions, Procedures, and Drawings"; QI 5.1, "Preparation of Quality Assurance Documents"; QR 6.0, "Document Control"; and QI 6.1, "Quality Assurance Document Control" (WHC 1989b). All procedures shall be made available for regulatory review on request at the direction of the Westinghouse Hanford project coordinator.

Table 1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the Phase II RI at 1100-EM-1. (sheet 1 of 3)

	Analytical Method	CRQL[a], Soil	Precision[b], Soil	Accuracy[b], Soil	CRQL[a], Water	Precision[b], Water	Accuracy[b], water
TCL Volatile Organics	CLP[c]	c	±35	±25	c	±25	75-125
TCL Semivolatile organics	CLP[c]	c	±35	±25	c	±25	75-125
TCL Pesticide/PCBs	CLP[c]	c	±35	±25	c	±25	75-125
TAL Inorganics	CLP[c]	c	±35	±25	c	±20	75-125
Alkalinity	310.1[d]	N/A	N/A	N/A	10,000 μg/l	±20	75-125
Ammonia as Nitrogen	350.3[d]	N/A	N/A	N/A	30 μg/l	±20	75-125
Bromide	300.0[e]	N/A	N/A	N/A	250 μg/l	±20	75-125
Chloride	300.0[e]	N/A	N/A	N/A	10,000 μg/l	±20	75-125
Chemical Oxygen Demand	410.1[d]	N/A	N/A	N/A	1,000 μg/l	±20	N/A
Coliform	502.1[f]	N/A	N/A	N/A	1 col/100 ml	±50	50-150
Specific Conductance[g]	120.1[d]	N/A	N/A	N/A	25 μmhos/cm	±20	N/A
Fluoride	300.0[e]	N/A	N/A	N/A	100 μg/l	±20	75-125
Nitrate	300.0[e]	N/A	N/A	N/A	100 μg/l	±20	75-125
Nitrite	300.0[e]	N/A	N/A	N/A	100 μg/l	±20	75-125
pH	150.1[d]	N/A	N/A	N/A	N/A	N/A	N/A
Temperature[g]	170.1[d]	N/A	N/A	N/A	N/A	±1°C	N/A
Phosphate	300.0[e]	N/A	N/A	N/A	500 μg/l	±20	75-125
Sulfate	300.0[e]	N/A	N/A	N/A	2,000 μg/l	±20	75-125

9 2 1 2 7 5 0 5 9 8

Table 1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the Phase II RI at 1100-EM-1. (sheet 2 of 3)

	Analytical Method	CRQL[a], Soil	Precision[b], Soil	Accuracy[b], Soil	CRQL[a], Water	Precision[b], Water	Accuracy[b], water
Dissolved Oxygen[f]	360.1[d]	N/A	N/A	N/A	100 µg/l	±20	N/A
Total Disolved Solids	160.1[d]	N/A	N/A	N/A	10,000 µg/l	±20	N/A
Total Organic Carbon	415.1[d]	N/A	N/A	N/A	1,000 µg/l	±20	75-125
Total Organic Halides	9020[f]	N/A	N/A	N/A	5 µg/l	±20	75-125
Turbidity	180.1[d]	N/A	N/A	N/A	0.05 NTU	± .05 NTU	N/A
Gross-Alpha	900.0[h]	0.75 pCi/g	±35	75-125	7.5 pCi/L	±20	75-125
Gross-Beta	900[h]	2.5 pCi/g	±35	75-125	25 pCi/L	±20	75-125
Gross-Gamma	[i]	1.0 pCi/g	±35	75-125	10 pCi/L	±20	75-125
Strontium-90	303[j]	0.4 pCi/g	±35	75-125	4 pCi/L	±20	75-125
Total Radium	[j]	0.25 pCi/g	±35	75-125	2.5 pCi/L	±20	75-125
Tritium	306[j]	50 pCi/g	±35	75-125	500 pCi/L	±20	75-125
Soil Gas							
Tetrachloroethylene	[k]	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethylene	[k]	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethane	[k]	N/A	N/A	N/A	N/A	N/A	N/A

Table 1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the Phase II RI at 1100-EM-1. (sheet 3 of 3)

	Analytical Method	CRQL[a], Soil	Precision[b], Soil	Accuracy[b], Soil	CRQL[a], Water	Precision[b], Water	Accuracy[b], water
Carbon tetrachloride	[k]	N/A	N/A	N/A	N/A	N/A	N/A

[a]CRQL = Contract required quantitation limit; values are to be considered requirements in the absence of known of suspected analytical interferences which may hinder achievement of the limit by the contract laboratory.

[b]Precision is expressed as relative percent difference; accuracy is expressed as percent recovery. These limits apply to sample results greater than five times the CRQL and are to be considered requirements in the absence of known or suspected analytical interferences which may hinder achievement of the limit by the contract laboratory.

[c]CLP = methods contained in EPA 1988a and EPA 1988b.

[d]Methods are from EPA 1979.

[f]Methods are from Lindahl 1984.

[f]Methods are from EPA 1986a.

[g]Parameter measured in the field.

[h]Methods are from Krieger and Whittaker 1980.

[i]Methods are from DOE 1987.

[j]Methods are from APHA 1985.

[k]Methods and quantitation limits shall be developed in compliance with Westinghouse Hanford or Westinghouse Hanford-approved participant contractor or subcontractor procedures.

Table 2. Supporting Procedures Matrix for Phase II of the 1100-EM-1 Remedial Investigation.
(sheet 1 of 5)

Procedure	Title or Subject	Source	Contaminant Source Investigations	Pedological Investigations	Hydrogeological Investigations	Ecological Investigations	Geodetic Control
EII 1.1	Hazardous Waste Site Entry Requirements	WHC-CM-7-7[a]	X	X	X	X	X
EII 1.2	Preparation & Revision of Environmental Investigation Instructions	WHC-CM-7-7[a]	X	X	X	X	X
EII 1.4	Deviation from Environmental Investigation Instructions	WHC-CM-7-7[a]	X	X	X	X	X
EII 1.5	Field Logbooks	WHC-CM-7-7[a]	X	X	X	X	X
EII 1.6	Records Management	WHC-CM-7-7[a]	X	X	X	X	X
EII 1.7	Indoctrination, Training & Qualification	WHC-CM-7-7[a]	X	X	X	X	X
EII 1.9	Work Plan Review	WHC-CM-7-7[a]	X	X	X	X	X
EII 1.10	Identifying, Evaluating, and Documenting Suspect Waste Sites	WHC-CM-7-7[a]	X				
EII 1.11	Technical Data Management	WHC-CM-7-7[a]	X	X	X	X	X
EII 2.1	Preparation of Hazardous Waste Operations Permits	WHC-CM-7-7[a]	X	X	X	X	X
EII 2.2	Occupational Health Monitoring	WHC-CM-7-7[a]	X	X	X		X
EII 2.3	Administration of Radiation Surveys to Support Environmental Characterization Work on the Hanford Site	WHC-CM-7-7[a]	X				
EII 3.1	User Calibration of Health and Safety Measuring and Test Equipment	WHC-CM-7-7[a]	X	X	X		X
EII 3.2	Health and Safety Monitoring Instruments	WHC-CM-7-7[a]	X	X	X	X	X
EII 3.3	Calibration Coordination (in prep)	WHC-CM-7-7[a]	X	X	X	X	X
EII 4.2	Interim Control of Unknown, Suspect Hazardous, and Mixed Waste	WHC-CM-7-7[a]		X	X		
EII 5.1	Chain of Custody	WHC-CM-7-7[a]	X	X	X		

Table 2. Supporting Procedures Matrix for Phase II of the 1100-EM-1 Remedial Investigation.
(sheet 2 of 5)

Procedure	Title or Subject	Source	Contaminant Source Investigations	Pedological Investigations	Hydrogeological Investigations	Ecological Investigations	Geodetic Control
EII 5.2	Soil and Sediment Sampling	WHC-CM-7-7[a]		X	X		
EII 5.4	Field Decontamination of Drilling, Well Development, and Sampling Equipment	WHC-CM-7-7[a]	X	X	X		
EII 5.5	1706 KE Laboratory Decontamination of RCRA/CERCLA Sampling Equipment	WHC-CM-7-7[a]	X	X	X		
EII 5.7A	Hanford Geotechnical Sample Library Control	WHC-CM-7-7[a]	X	X	X		
EII 5.8	Groundwater Sampling	WHC-CM-7-7[a]			X		
EII 5.9	Soil Gas Sampling	WHC-CM-7-7[a]	X		X		
EII 5.10	Sample Identification and Data Entry into HEIS Database	WHC-CM-7-7[a]	X	X	X		X
EII 5.11	Sample Packaging and Shipping	WHC-CM-7-7[a]	X	X	X		
EII 6.1	Activity Reports of Field Operations	WHC-CM-7-7[a]	X	X	X	X	X
EII 6.5	Plugging and Abandoning of Characterization Boreholes	WHC-CM-7-7[a]		X	X		
EII 6.7	Groundwater Well and Borehole Drilling	WHC-CM-7-7[a]		X	X		
EII 6.8	Well Completion	WHC-CM-7-7[a]			X		
EII 6.9	Groundwater Well and Borehole Identification and Tracking	WHC-CM-7-7[a]		X	X		
EII 8.3	Remediation of Groundwater Wells	WHC-CM-7-7[a]			X		
EII 9.1	Geologic Logging	WHC-CM-7-7[a]		X	X		
EII 10.1	Aquifer Testing	WHC-CM-7-7[a]			X		
EII 10.2	Measurement of Ground-Water Levels	WHC-CM-7-7[a]			X		
EII 10.3	Purge Water Management	WHC-CM-7-7[a]			X		

Table 2. Supporting Procedures Matrix for Phase II of the 1100-EM-1 Remedial Investigation.
(sheet 3 of 5)

Procedure	Title or Subject	Source	Contaminant Source Investigations	Pedological Investigations	Hydrogeological Investigations	Ecological Investigations	Geodetic Control
EII 10.4	Well Development Activities	WHC-CM-7-7[a]			X		
EII 11.1	Geophysical Logging	WHC-CM-7-7[a]		X	X		
EII 11.2	Geophysical Survey Work	WHC-CM-7-7[a]	X				
EII 12.1	Geodetic Surveying	[b]					X
[b]	Analytical Data Validation	[b]	X	X	X		
WMC-CM-04-12[c]	Surface Radiation Survey	WHC-CM-4-12[c]	X				
D2216	Standard Methods for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures	ASTM[d]		X	X		
QR 1.0	Organization	WHC-CM-4-2[e]	X	X	X	X	X
QAI 2.2	Qualification of Quality Assurance Inspection and Test Personnel	WHC-CM-4-8[f]	X	X	X	X	X
QAI 2.3	Qualification of Quality Assurance Program Audit Personnel	WHC-CM-4-8[f]	X	X	X	X	X
QR 4.0	Procurement Document Control	WHC-CM-4-2[e]	X	X	X	X	X
QI 4.1	Procurement Document Control	WHC-CM-4-2[e]	X	X	X	X	X
QI 4.2	External Services Control	WHC-CM-4-2[e]	X	X	X	X	X
QR 5.0	Instruction, Procedures, and Drawings	WHC-CM-4-2[e]	X	X	X	X	X
QI 5.1	Preparation of Quality Assurance Documents	WHC-CM-4-2[e]	X	X	X	X	X
QR 6.0	Document Control	WHC-CM-4-2[e]	X	X	X	X	X
QI 6.1	Quality Assurance Document Control	WHC-CM-4-2[e]	X	X	X	X	X
QR 7.0	Control of Purchased Items and Services	WHC-CM-4-2[e]	X	X	X	X	X

Table 2. Supporting Procedures Matrix for Phase II of the 1100-EM-1 Remedial Investigation.
(sheet 4 of 5)

Procedure	Title or Subject	Source	Contaminant Source Investigations	Pedological Investigations	Hydrogeological Investigations	Ecological Investigations	Geodetic Control
QI 7.1	Procurement Planning and Control	WHC-CM-4-2*	X	X	X	X	X
QI 7.2	Supplier Evaluation	WHC-CM-4-2*	X	X	X	X	X
QI 7.3	Source Surveillance and Inspection	WHC-CM-4-2*	X	X	X	X	X
QI 10.4	Surveillance	WHC-CM-4-2*	X	X	X	X	X
QI 12.0	Control of Measuring and Test Equipment	WHC-CM-4-2*	X	X	X		X
QI 12.1	Acquisition and Calibration of Portable Measuring and Test Equipment	WHC-CM-4-2*	X	X	X		X
QI 12.2	Measuring and Test Equipment Calibration by User	WHC-CM-4-2*	X	X	X		X
QR 14.0	Inspection, Test, and Operating Status	WHC-CM-4-2*	X	X	X	X	X
QI 14.1	Inspection and Test Status Indicators	WHC-CM-4-2*	X	X	X	X	X
QI 15.1	Nonconforming Item Reporting	WHC-CM-4-2*	X	X	X	X	X
QI 15.2	Nonconformance Report Processing	WHC-CM-4-2*	X	X	X	X	X
QR 16.0	Corrective Action	WHC-CM-4-2*	X	X	X	X	X
QI 16.1	Trending/Trend Analysis	WHC-CM-4-2*	X	X	X	X	X
QI 16.2	Corrective Action Reporting	WHC-CM-4-2*	X	X	X	X	X
QI 16.4	Review of Processing of External Event Reports	WHC-CM-4-2*	X	X	X	X	X
QR 17.0	Quality Assurance Records	WHC-CM-4-2*	X	X	X	X	X
QI 17.1	Quality Assurance Records Control	WHC-CM-4-2*	X	X	X	X	X
QR 18.0	Audits	WHC-CM-4-2*	X	X	X	X	X
QI 18.1	Audit Programming and Scheduling	WHC-CM-4-2*	X	X	X	X	X

Table 2. Supporting Procedures Matrix for Phase II of the 1100-EM-1 Remedial Investigation.
(sheet 5 of 5)

Procedure	Title or Subject	Source	Contaminant Source Investigations	Pedological Investigations	Hydrogeological Investigations	Ecological Investigations	Geodetic Control
QAI 18.1	Planning, Performing, Reporting, Follow-up, and Closure of Quality Assurance Audits	WHC-CM-4-8[f]	X	X	X	X	X

Notes:

[a]WHC 1989c
[b]Procedures shall be developed by participant or support contractors in compliance with Section 4.3.2, or by Westinghouse Hanford in compliance with EII 1.2 (WHC 1989c).
[c]WHC 1988
[d]ASTM 1989
[e]WHC 1989b
[f]WHC 1990b

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4.1.2 Participant Contractor/Subcontractor Procedures

As noted in Section 2.1, participant contractor and subcontractor services shall be procured under the applicable Westinghouse Hanford procedures. Whenever such services for Westinghouse Hanford are required, requirements for the review and approval of all applicable procedures shall be included in the procurement document or work order, as applicable. In addition to the submittal of analytical procedures, analytical laboratories shall be required to submit the current revision of their internal QA program plans. Prior to use, all analytical laboratory plans and procedures shall be reviewed and approved by qualified personnel, as directed by the project coordinator; all reviewers shall be qualified under the requirements of EII 1.7, "Indoctrination, Training, and Qualification" (WHC 1989c). All participant contractor or subcontractor procedures, plans, and/or manuals shall be retained as project quality records in compliance with EII 1.6, "Records Management" (WHC 1989c); QR 17.0, "Quality Assurance Records"; and QI 17.1, "Quality Assurance Records Control" (WHC 1989b). All such documents shall be made available for regulatory review on request at the direction of the Westinghouse Hanford project coordinator.

4.1.3 Procedure Change Control

Deviations from established EIIs that may be required in response to unforseen field situations may be authorized in compliance with EII 1.4, "Deviation from Environmental Investigations Instructions"(WHC 1989c). Documentation, review, approval, and disposition requirements shall be as specified therein. Other types of change requests applicable to QRs and QIs shall be approved, as required, by QR 6.0, "Document Control", and QI 6.1, "Quality Assurance Document Control" (WHC 1989b). Deviations from established radiation surveying and monitoring procedures shall be authorized only within applicable portions of the guidelines established by the *Operational Health Physics Practices Manual*, WHC-CM-4-12 (WHC 1988). As noted in Section 1.4 above, interim changes to this QAPP, the supplemental work plan, or other plan-level documents shall be documented, reviewed, and approved in compliance with Section 6.6 of EII 1.9, "Work Plan Review" (WHC 1989c).

4.2 SAMPLING PROCEDURES

4.2.1 Soil Sample Acquisition

All soil sampling shall be conducted in compliance with EII 5.2, "Soil and Sediment Sampling" (WHC 1989c). Borehole drilling in support of soil sample acquisition shall be in compliance with EII 6.7, "Groundwater Well and Borehole Drilling"(WHC 1989c). Other applicable EIIs and procedures related to soil sampling activities are specified in Table 2.

4.2.2 Water Sample Acquisition

All water sampling shall be performed in compliance with EII 5.8, "Groundwater Sampling." Other EIIs and procedures related to water sampling, groundwater well installation, development, and maintenance are specified in Table 2.

4.2.3 Soil Gas Sample Acquisition

All soil gas sampling shall be conducted in compliance with EII 5.9, "Soil Gas Sampling"; other supporting procedures and EIIs are specified in Table 2.

4.3 SAMPLE IDENTIFICATION, LOCATION, AND FREQUENCY

The sample identification described in EII 5.10 "Sample Identification and Data Entry into HEIS Database" (WHC 1989c) which is in preparation, will be used to designate samples obtained during the Phase II RI.

Sample location and frequency shall be as defined in Chapter 4.0 of the supplemental work plan (see Sections 4.2 through 4.7 and Figures 4-1 through 4-17). Field quality control (QC) sample frequencies shall meet the minimum requirements defined in Chapter 9.0 below.

4.4 SAMPLE CONTAINER PREPARATION, HANDLING, PRESERVATION, AND SHIPPING

Sample container selection, preparation, and preservation shall be as specified in EII 5.2, "Soil and Sediment Sampling"; EII 5.8, "Groundwater Sampling"; or EII 5.9, "Soil Gas Sampling" (WHC 1989c), as appropriate for the type of sample involved. All samples shall be packaged and shipped in compliance with the applicable requirements of EII 5.11, "Sample Packaging and Shipping" (WHC 1989c), subject to the chain of custody controls described in Chapter 5.0 below.

4.5 SAMPLING EQUIPMENT DECONTAMINATION

Field support equipment and sample acquisition equipment shall be decontaminated prior to use as required by EII 5.4, "Field Decontamination of Drilling, Well Development, and Sampling Equipment", and/or EII 5.5, "Decontamination of Equipment for RCRA/CERCLA Sampling" (WHC 1989c), as appropriate for the equipment type.

5.0 SAMPLE CUSTODY

All samples obtained during the course of this investigation shall be controlled, as required, by EII 5.1 "Chain of Custody" (WHC 1989c) from the point of origin to the analytical laboratory. Laboratory chain-of-custody procedures shall be reviewed and approved in compliance with the requirements of Section 4.1 above, as applicable, and shall ensure the maintenance of sample integrity and identification throughout the analytical process. At the direction of the Westinghouse Hanford project coordinator, requirements for the return of residual sample materials after completion of analysis shall be defined in accordance with procedures defined in the procurement documentation to subcontractor or participant contractor laboratories. Chain-of-custody forms shall be initiated for returned residual samples, as required by the approved procedures applicable within the laboratory. Results of analyses shall be traceable to original samples through the unique numerical sample identifier discussed in Chapter 4.0 and Table 3 above. All analytical results shall be controlled as permanent project quality records as required by QR 17.0, "Quality Assurance Records," (WHC 1989b) and EII 1.6, " Records Management," (WHC 1989c).

6.0 CALIBRATION PROCEDURES

Calibration of all Westinghouse Hanford measuring and test equipment, whether in an existing inventory or purchased for this investigation, shall be controlled as required by QR 12.0, "Control of Measuring Test Equipment"; QI 12.1, "Acquisition and Calibration of Portable Measuring and Test Equipment" (WHC 1989b); QI 12.2, "Measuring and Test Equipment Calibration by User" (WHC 1989b); EII 3.1, "User Calibration of Health and Safety M&TE" (WHC 1989c); and/or WHC-CM-4-12 (WHC 1988). Routine operational checks for Westinghouse Hanford field equipment shall be as defined within applicable EIIs, procedures or governing manual sections; similar information shall be provided in Westinghouse Hanford-approved participant contractor or subcontractor procedures.

Calibration of laboratory analytical equipment shall be as defined by Westinghouse Hanford-approved laboratory QA project plans or the applicable reference methods specified in Table 1.

7.0 ANALYTICAL PROCEDURES

Analytical methods identified in Table 1 shall be selected or developed and approved before they are used, in compliance with appropriate Westinghouse Hanford procedure and/or procurement control requirements. As noted in Section 3.0, Table 1 provides general guidelines and reference sources for target contractual quantitation limits and target values for precision and accuracy for each analyte of interest. Once individual laboratory statements of work are negotiated, and procedures are approved in compliance with the requirements of Section 4.1.2,

Table 1 shall be revised to include actual method references, approved contractual quantitation limit, precision, and accuracy criteria as project requirements; all such changes shall be documented as required by Section 6.6 of EII 1.9 "Work Plan Review" (WHC 1989c), and shall be documented as part of monthly unit managers' meeting minutes.

All analytical procedures approved for use in this investigation shall require the use of standard reporting techniques and units to facilitate the comparability of data sets in terms of precision and accuracy. All approved procedures shall be retained in the project quality records and shall be available for review upon request at the direction the Westinghouse Hanford project coordinator.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 DATA REDUCTION AND DATA PACKAGE PREPARATION

All subcontractor or participant contractor analytical laboratories shall be responsible for preparing a report summarizing the results of analysis and for preparing a detailed data package that includes identification of samples, sampling and analysis dates, raw analytical data, reduced data, data outliers, reduction formulae, recovery percentages, quality control check data, equipment calibration data, supporting chromatograms or spectrograms, and documentation of any nonconformances affecting the measurement system in use during sample analysis. Data reduction schemes shall be contained within individual laboratory analytical methods and/or QA project plans, subject to Westinghouse Hanford review and approval as discussed in Section 4.1. The completed data package shall be reviewed and approved by the analytical laboratory's QA manager before it is submitted to the Westinghouse Hanford Office of Sample Management (OSM) for validation. The requirements of this section shall be included in procurement documentation or work orders, as appropriate, in compliance with standard Westinghouse Hanford procurement control procedures noted in Section 4.1.

8.2 VALIDATION

Data validation shall be performed by the Westinghouse Hanford OSM in compliance with procedures approved by the project coordinator. At a minimum, OSM data validation procedures shall meet the requirements of Sections 8.2.1, 8.2.2, and 8.2.3 below.

8.2.1 Screening Analyses -- Verification and Report Preparation Requirements

Screening analyses shall have been performed in compliance with Westinghouse Hanford-approved procedures, as noted in Section 4.1. Verification of screening data quality shall be in compliance with applicable Westinghouse Hanford EIIs; verification of screening data obtained using laboratory methods shall, at a minimum, be verified by comparison with laboratory data validated in compliance with Sections 8.2.2 and 8.2.3 below.

8.2.2 Standard Analyses -- Validation and Report Preparation Requirements

All standard procedure analyses shall be validated in general compliance with Westinghouse Hanford *Sample Management Administration Manual* WHC-CM-5-3 (WHC 1990), Section 2.2, for organics analyses and Section 2.1 for inorganics analyses.

8.2.3 Special Analyses -- Validation and Report Preparation Requirements

All validation of radionuclide analyses shall be performed in compliance with specific procedures developed by the OSM; all such procedures shall be approved by the Operable Unit Technical Coordinator, and shall address the following minimum requirements:

- review of calibration data for each instrument/technique
- review of verification data for determination of lower limit of detection (LLD) and/or minimum detectable activity (MDA)
- review of blank data
- review of spike sample recovery data
- review of detector efficiency calculations and data for each applicable geometry
- review of counting error calculation data
- review of ingrowth correction factors, as applicable to sample result calculations
- review of duplicate analysis data
- review of laboratory control sample data
- verification of receipt of all raw data for all instruments used to report sample data, plus all routine QA/QC data
- verification of receipt of all analytical results in compatible electronic format
- review of chain of custody records.

Validation of all organic and inorganic samples in radioactive matrices shall be in compliance with Section 8.2.2 above.

8.3 FINAL REVIEW AND RECORDS MANAGEMENT CONSIDERATIONS

At the discretion of the Westinghouse Hanford project coordinator, all screening verification reports, validation reports and supporting analytical data packages shall be subjected to a final technical review by a qualified reviewer before they are submitted to the regulatory agencies, or are included in reports or technical memoranda. All reports, data packages, and review comments shall be retained as permanent project quality records in compliance with EII 1.6, "Records Management" (WHC 1989c), and QR 17.0, "Quality Assurance Records" (WHC 1989b).

9.0 INTERNAL QUALITY CONTROL

All analytical samples shall be subject to in-process QC measures in both the field and the laboratory. The following minimum field QC requirements apply for validated analyses. These requirements are adapted from *Test Methods for Evaluating Solid Waste* (EPA 1986b), as modified by the proposed rule changes included in the *Federal Register*, 1989, Volume 54, No. 13, pp 3212-3228, and 1990, Volume 55, No. 27, pp 4440-4445.

- Field duplicate samples: For each shift of sampling activity under an individual sampling subtask, a minimum of 5% of the total collected samples shall be duplicated. Duplicate samples shall be retrieved using the same equipment and sampling technique and shall be placed into two identically prepared and preserved containers. All field duplicates shall be analyzed independently as an indication of gross errors in sampling techniques.

- Split samples: At the Westinghouse Hanford project coordinator's direction, field or field duplicate samples may be split in the field and sent to an alternate laboratory as a performance audit of the primary laboratory. Frequency shall meet the minimum schedule requirements of Chapter 10.0.

- Blind samples: At the Westinghouse Hanford project coordinator's direction, blind or double-blind reference samples may be introduced into any sampling round (in lieu of split samples) as a performance audit of primary laboratory. Blind sample type and frequency shall be as directed by the Westinghouse Hanford project coordinator; frequency shall meet the minimum schedule requirements for performance audits described in Chapter 10.0.

- Field blanks: Field blanks shall consist of pure deionized distilled water, transferred into a sample container at the site and preserved with the reagent specified for the analytes of interest. Field blanks are used as a check on reagent and environmental contamination and shall be collected at the same frequency as field duplicate samples.

- Equipment blanks: Equipment blanks shall consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures and shall be collected at the same frequency as field duplicate samples.

- Trip blanks: Trip blanks consist of pure deionized distilled water added to one clean sample container, accompanying each batch of containers shipped to the sampling activity. Trip blanks shall be returned unopened to the laboratory and are prepared as a check on possible contamination originating from container preparation methods, shipment, handling, storage, or site conditions. In compliance with standard Westinghouse Hanford procurement procedures, requirements for trip blank preparation shall be included in procurement documents of work orders to the sample container supplier and/or preparer.

Internal QC checks for fully validated analyses shall be as specified by the laboratory's approved QA plan and shall meet the following minimum requirements:

- Matrix spike/matrix spike duplicate samples: Matrix spike and matrix spike duplicate samples require the addition of a known quantity of a representative analyte of interest to the sample as a measure of recovery percentage and as a test of analytical precision. The spike shall be made in a replicate of a field duplicate sample. Replicate samples are separate aliquots removed from the same sample container in the laboratory. Spike compound selection, quantities, and concentrations shall be described in the laboratory's approved analytical methods. One sample shall be spiked for each analytical batch, or once every 20 samples, whichever is greater.

- QC reference samples: A QC reference sample shall be prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. Reference samples are required as an independent check on analytical technique and methodology and shall be run with every analytical batch, or every 20 samples, whichever is greater.

The minimum requirements of this section shall be invoked in procurement documents or work orders, in compliance with standard Westinghouse Hanford procedures as noted in Section 4.1.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance, system, and program audits are scheduled to begin early in the execution of this work plan and continue through work plan completion. Collectively the audits address quality affecting activities that include but are not limited to, measurement system accuracy, intramural and extramural analytical laboratory services, field activities, and data collection, processing, validation and management.

Performance audits of the accuracy of laboratory analysis are implemented in accordance with Standard Operating Procedure EII 1.12 "Laboratory Analysis Performance Audits" (WHC 1989c) which is in preparation. System audit requirements are implemented in accordance with Standard Operating Procedure QI 10.4, "Surveillance" (WHC 1989b). Surveillances will be performed regularly throughout the course of the work plan activities. Additional performance and system "surveillances" may be scheduled as a consequence of corrective action requirements, or may be performed upon request. All quality affecting activities are subject to surveillance.

All aspects of inter-operable unit activities will also be evaluated as part of routine environmental restoration program-wide QA audits under the Standard Operating Procedure requirements of WHC-CM-4-2 (WHC 1989b). Program audits shall be conducted in accordance with QR 18.0, "Audits," "Audit Programming and Scheduling (WHC 1989b)," and QAI 18.1, "Planning, Performing, Reporting, and Follow-up, and Closure of Quality Audits" by auditors qualified in accordance with QAI 2.3, "Qualification of Quality Assurance Program Audit Personnel" (WHC 1990b).

11.0 PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field and laboratory that directly affects the quality of the field and analytical data shall be subject to preventive maintenance measures that ensure minimization of measurement system downtime and corresponding schedule delays. Laboratories shall be responsible for performing or managing the maintenance of their analytical equipment. Maintenance requirements, spare parts list, and instructions shall be included in individual methods or in laboratory QA plans, subject to Westinghouse Hanford review and approval. Westinghouse Hanford field equipment shall be drawn from inventories subject to standard preventive maintenance procedures. Field procedures submitted for Westinghouse Hanford approval by participant contractors or subcontractors shall contain provisions for preventive maintenance, maintenance schedules, and spare parts lists to ensure minimization of equipment downtime.

12.0 DATA ASSESSMENT PROCEDURES

As noted in Section 4.9 of the supplemental work plan, the data generated during the Phase II RI will be monitored on an ongoing basis. Data evaluation summaries shall be prepared and reported to the project coordinator on a monthly basis in order to facilitate any necessary redirection or emphasis of the characterization effort. Where data are generated in sufficient quantity to warrant such analysis, the project coordinator may direct the application of specific statistical or probabilistic techniques in the process of data comparison and analysis. Such techniques are likely to include the calculation of tolerance limits, and the calculation of confidence limits, as discussed in the following sections.

12.1 TOLERANCE LIMIT CALCULATIONS

Each hazardous substance has a certain background distribution in a given environmental medium. Before a substance can be regarded as a site-specific contaminant, it must be found to occur at concentrations exceeding (or for pH, lying outside) the local background distribution. Site-specific tolerance limits will be calculated to make these determinations in an objective manner.

All environmental-medium-specific background distributions will be assumed to be normal, unless non-normality can be demonstrated. One-sided tolerance limits corresponding to the 95th percentile of the background distribution, with a degree of confidence of 95%, will be calculated in accordance with the methodology provided in EPA (1989a). Two-sided tolerance limits corresponding to the 5th and 95th percentiles of the background distribution, with a degree of confidence of 95%, will be calculated for pH in accordance with the methodology provided in Miller and Freund (1965).

12.2 CONFIDENCE LIMIT CALCULATIONS

During a baseline risk assessment, reasonable maximum exposures concentrations and other factors are estimated. In accordance with EPA (1989b), reasonable maximum risk assessment factors are calculated by substituting a mean value with a conservatively biased estimate of the mean. Such estimates are obtained from the calculation of an upper or lower (whichever provides the conservative estimate) confidence limit of the distribution of the mean.

Mean value distributions used in exposure assessment will be assumed to be normal. One-sided, 95% confidence limits will be calculated in accordance with the methodology provided in Miller and Freund (1965).

13.0 CORRECTIVE ACTION

Corrective action requests required as a result of surveillance reports, nonconformance reports, or audit activity shall be documented and dispositioned as required by QR 16.0, "Corrective Action"; QI 16.1, "Trending/Trend Analysis"; and QI 16.2, "Corrective Action Reporting" (WHC 1989b). Other measurement system procedure or plan corrections that may be required as a result of data assessment or routine review processes shall be resolved as required by governing procedures or shall be referred to the Westinghouse Hanford project coordinator for resolution. Copies of all surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project quality records upon completion or closure.

14.0 QUALITY ASSURANCE REPORTS

As previously stated in Chapters 10.0 and 13.0, project activities shall be regularly assessed by performance and system auditing and associated corrective action processes. Surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project quality records upon completion or closure of the activity. A report summarizing all audit, surveillance, and instruction change authorization activity (see Section 4.4), as well as any associated corrective actions or trend analysis reports, shall be prepared for the Westinghouse Hanford project coordinator by the quality coordinator at the completion of the South Pit investigation. Such information will be evaluated and integrated into the evaluations addressed by the data evaluation and risk assessment tasks. The report shall include an assessment of the overall adequacy of the total measurement system with regard to the data quality objectives of this phase of the investigation.

15.0 REFERENCES

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APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

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Sample Handling Protocol	ER 1110-1-263, App F	X	X
Procedures for Measurement of Depth to Water in Wells at DOE-RL	NPW-H-P 200-1-1	X	
Procedures for Management of Purge Water at DOE-RL	NPW-H-P 200-1-3	X	
USACE Chemical Quality Assurance	ER 1110-1-263, App E	X	X
Procedures for Obtaining Entry into Hazardous Waste Sites at DOE-RL	NPW-H-P 385-1-2	X	
Data Generation and Processing	CEQAPP 1.1 Rev 1, Sec 3.10	X	X
Site Safety and Health Plan	DOE/RL-90-37, App D	X	
Procedures for Maintenance and Calibration of Health & Safety Monitoring Instruments	NPW-H-P 385-1-1	X	
Sample Handling and Analysis	DOE/RL-90-37, App C	X	X
Line Organization and Responsibility	CEQAPP 1.1 Rev 1, Sec 2.2	X	
Personnel Qualification for Inspection and Test Personnel	CEQAPP 1.1 Rev 1, Sec 3.5.1.4	X	X
Qualification of Quality Assurance Program Audit Personnel	CEQAPP 1.1 Rev 1, App C	X	
Procurement Document Control	CEQAPP 1.1 Rev 1, Sec 5.0	X	
Design Control	CEQAPP 1.1 Rev 1, Sec 4.0	X	X
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Title or Subject	Source & Procedure	Groundwater Sampling	Laboratory Testing
Control of Purchased Items and Services	CEQAPP 1.1 Rev 1, Sec 8.0	X	X
Procurement Planning	CEQAPP 1.1 Rev 1, Sec 8.4	X	X
Acceptance of Items or Services	CEQAPP 1.1 Rev 1, Sec 8.10	X	X
Quality Assurance Surveillance	CEQAPP 1.1 Rev 1, Sec 3.6	X	X
Control of Measuring and Test Equipment	CEQAPP 1.1 Rev 1, Sec 13.0	X	X
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Reporting and Resolution of Significant Conditions Adverse to Quality	CEQAPP 1.1 Rev 1, Sec 17.4	X	X
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Legend
ER - U.S. Army Corps of Engineers Regulation
CEQAPP - U.S. Army Corps Of Engineers Quality Assurance Program Plan
NPW-H-P - U.S. Army Corps of Engineers, Walla Walla District Hanford Pamphlet
DOE-RL - U.S. Department of Energy Field Office, Richland

QAPjP Locator Page

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5.4	Project Organization and Responsibility	A-3/B-14	CEQAPP, Sec 2.0
5.5	QA Objectives for Measurement Data-PARCC	A-4/B-18	
5.6	Sampling Procedures	A-5/B-21	CEQAPP, Sec 18; FSP
5.7	Sample Custody	A-17/B-25	DOE/RL-90-37, APP A; ER 1110-1-263
5.8	Calibration Procedures and Frequency	A-17/B-26	ER 1110-1-263
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5.10	Data Reduction, Validation and Reporting	A-18/B-26	
5.11	Initial Quality Control Checks	A-20/B-27	
5.12	Performance and System Audits	A-21/B-29	CEQAPP, Sec 19
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5.14	Specific Routine Procedures	A-22/B-30	DOE/RL-90-37, Sec 4.9
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5.16	Quality Assurance Reports to Management	A-24/B-31	CEQAPP, Sec 3.6, 3.7, & 3.8

1.0 PROJECT DESCRIPTION

1.1 Background

The 1100-EM-1 Operable Unit is shown on figure 1-A. Detailed background information regarding the historical and present use of the unit is provided in chapter 2.0 of the Phase I Remedial Investigation (RI) report (DOE/RL-90-18); results of Phase I activities are also discussed in detail in the Phase I RI report.

On October 1, 1991, the U.S. Army Corps of Engineers (USACE), Walla Walla District (CENPW), assumed responsibility for conducting and completing RI activities for the 1100-EM-1 Operable Unit as described in the Scope of Work for the U.S. Department of Energy Field Office, Richland (DOE-RL) Master Interagency Agreement (IA) between DOE-RL and USACE, North Pacific Division (CENPD) (signed July 7, 1990) and the specific project Task Order Number DE-AT06-90RL12103 between DOE-RL and CENPW (signed September 28, 1990). At the time these documents were signed, the Phase II RI was the responsibility of Westinghouse Hanford Company (WHC) and was scheduled for completion in early 1991. Subsequently, the preparation of the Phase II RI report became the responsibility of CENPW and was scheduled to be completed and delivered to DOE-RL September 30, 1991 according to the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement (TPA)) milestone M-15-01B. This milestone was renegotiated and consolidated with milestone M-15-01C to become a new milestone M-15-01B/C for submittal in December 1992 of a combined Phase II RI /Phase III Feasibility Study (FS) report to the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology. The purpose of the new milestone was to allow inclusion of important additional radiochemical analysis data and the results from additional field activities.

All required field activities described in the Supplemental Work Plan (DOE/RL-90-37 (Revision 1)) were completed by WHC before December 1991. WHC will continue to be responsible for completion of the analysis of environmental samples they collected from 1100-EM-1 prior to December 1991. As per the IA and Task Order Number DE-AT06-90RL12103 between DOE-RL and CENPW, CENPW is now responsible for completion of all RI activities, including coordination and integration of all ongoing remedial efforts at the 1100-EM-1 Operable Unit.

1.2 Purpose

Although the sampling and data collection activities for the preparation of the RI/FS report is considered to be complete, monitoring of the groundwater at 1100-EM-1 is to continue to satisfy regulatory requirements, to identify and quantify the radiochemical analyte(s) responsible for the gross ß in the groundwater at Horn Rapids Landfill (HRL), and to clarify further the source of a groundwater plume containing nitrate and trichloroethylene at HRL.

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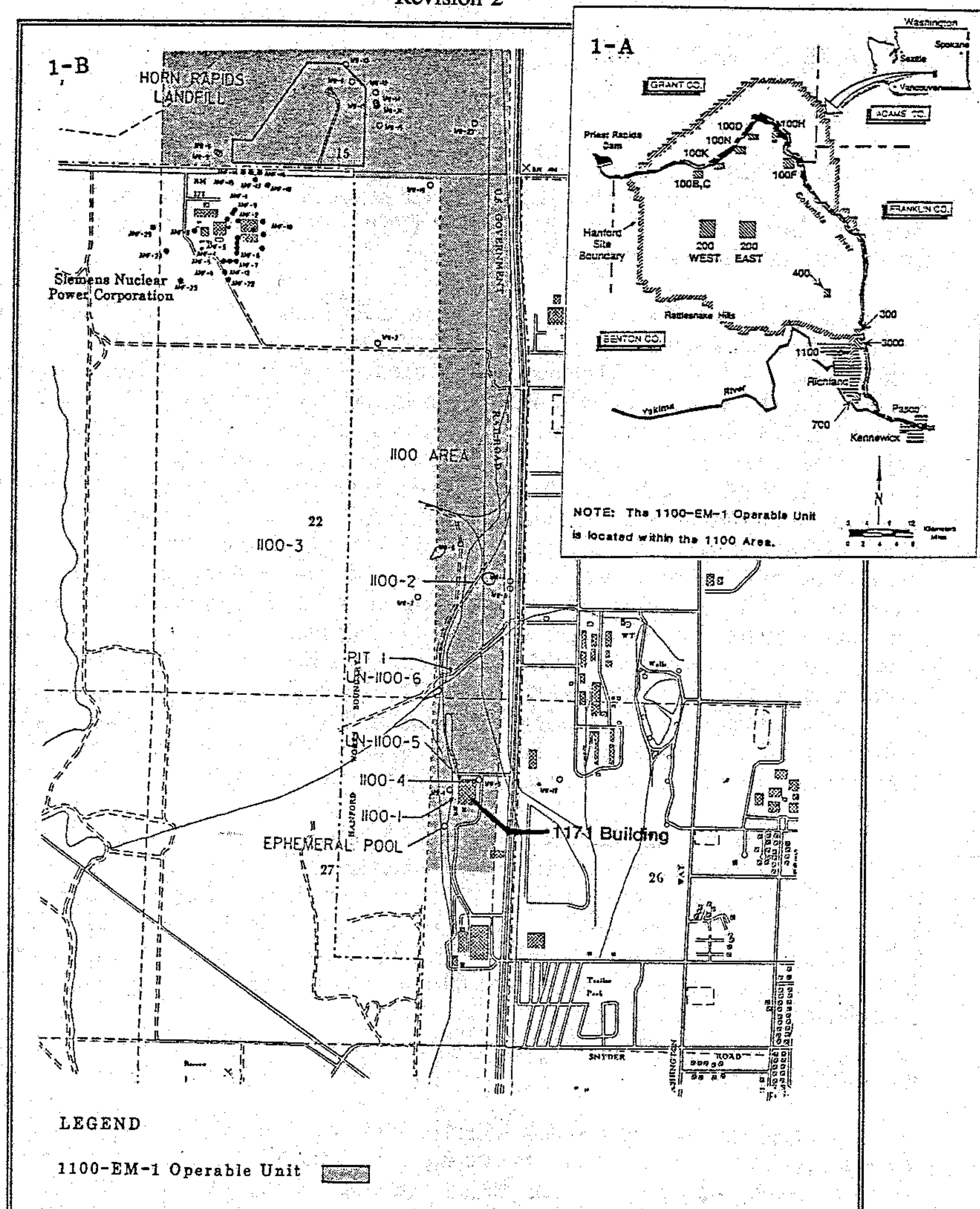

Figure 1. A-Location of the 1100-EM-1 Operable Unit at the Hanford Facility: B-Location of the Operable Subunits Within 1100-EM-1.

The purpose of this document is to define the quality assurance requirements for the continuing groundwater monitoring including the associated analytical services and data evaluation. The schedule (DOE-RL 90-37, Revision 2, figure 5.1) shows that the bulk of the data to be collected, analyzed, and validated will not be available for incorporation into the RI/FS report. However, data made available during the preparation of the report will be considered when possible. The anticipated end use of the data collected after December 1991 is threefold: 1) to resolve whether the contaminant groundwater plume(s) at HRL originates from an onsite or offsite source, 2) to ensure, via continued monitoring, that the status of groundwater is routinely updated, and 3) to enable future refinement of the site conceptual model (and risk assessment), if necessary.

This is one of five documents defining the strategy and methodology with which CENPW proposes to monitor groundwater during the time period from December 1991 until completion of RI activities. The other documents include the Work Plan, Field Sampling and Analysis Plan (FSP), Site Safety and Health Plan (SSHP), and Community Relations Plan (CRP[1]). This QAPjP describes the CENPW quality assurance requirements specific to groundwater monitoring at 1100-EM-1 and was prepared in compliance with the CENPW Quality Assurance Program Plan for the Support of DOE-RL (CEQAPP version 1.10, revision 1) and EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA/540/G-89/004, October 1988).

Data evaluated to prepare this QAPjP and the accompanying FSP were: 1) Phase I surface and subsurface soil sampling data, 2) Phase II groundwater monitoring data, and 3) additional available data from 1991 groundwater sampling rounds and results from the soil-gas and radiological survey.

1.3 Project Objective and Strategy

The initial objective of the Phase II RI/Phase III FS for the 1100-EM-1 Operable Unit is to define the extent and location of sources of radioactive, organic, inorganic, and other types of contaminants in the vadose zone and groundwater in addition to monitoring and mapping the groundwater levels. The ultimate objective is to identify alternatives for the remediation of media determined to be contaminated at levels which may be detrimental to human health and the environment.

1.3.1 Overview--To meet this objective, subunits suspected of having surface and subsurface contamination have been sampled and the data presented in the *Phase I Remedial Investigation Report for the Hanford Site 1100-EM-1 Operable Unit* (DOE/RL-90-18) and summarized in columns 2 and 3 of table 1 of this document. All subunits have been surveyed for radiological surface contamination and determined to be free of such contamination. Eight complete groundwater sampling events have occurred at 1100-EM-1. The strategy utilized for the monitoring was conservative in its scope and included analyses

[1] CENPW will adopt the existing 1100-EM-1 CRP (DOE/RL-88-23) without modification.

for all EPA regulated target analytes and groundwater quality parameters. Only one site, Horn Rapids Landfill (HRL), shows clear evidence of groundwater contamination above EPA's maximum concentration limits (MCL's); the contaminants of concern being nitrate, trichloroethylene (TCE), and gross beta (ß). One well near the 1171 Building (figure 2) shows inconclusive evidence for nickel concentrations near the proposed MCL. Data from the groundwater monitoring events that occurred in calendar year 1990 have been presented in the *Interim Groundwater Data Summary Report for the 1100-EM-1 Operable Unit for 1990*. The data for the first two rounds in 1991 are summarized in *Groundwater Data Quality Report for the 1100-EM-1 Operable Unit for First and Second Quarter 1991*. These sampling rounds are summarized in column 4 of table 1.

Table 1. Operable Unit Specific Surface and Subsurface Soil Contamination

Operable Subunit	Identified Soil Organic Contaminants	Identified Soil Inorganic Contaminants	Identified Groundwater Contamination (nearest monitoring well(s))
1100-1 (Battery Acid Pit)	none	Chromium, Copper, Lead^{+}, Zinc, Mercury	Nitrate/Nitrite (MW-1)
1100-2 (Paint & Solvent Pit)	4,4'-DDT, trichloroethylene	Copper, Lead^{+}, Thallium	none (MW-4,5,6,7)
1100-3	none	Antimony^{+}, Chromium, Copper, Lead	not monitored, (MW-4,5,6,7 are hydrogeologically down-gradient, but physically distant)
1100-4	none	Arsenic, Silver, Zinc	Nitrate/Nitrite, possible Nickel contamination (MW-3)
UN-1100-5	none	none	Nitrate/Nitrite (MW-1,3)
UN-1100-6 Stained Soil Site	Bis(2-ethylhexyl)phthalate^{++}, di-n-octyl phthalate^{++}, 1,1,1-trichloroethane, α-chlordane^{+}, τ-chlordane^{+}, 4,4'DDE, heptachlor	Lead, Zinc	not monitored
Ephemeral Pool	arachlor-1248 (PCB), endosulfan II, α-chlordane, τ-chlordane	Lead	not monitored
Horn Rapids Landfill	2-methylnaphthalene^{++}, naphthalene, 4,4'DDD^{++}, 4,4'DDE^{++}, 4,4'DDT^{+}, aroclor-1248^{++}	Arsenic, Barium^{++}, Cadmium^{++}, Lead^{++}, Mercury^{++}, Nickel^{+}, Zinc^{++}, Thallium, Beryllium, Chromium^{++}, Silver^{+}, Copper	Nitrate/Nitrite^{++}, TCE^{++} gross ß (MW-8,10,11,12,14,15,20 & 21; 6-S29-E12)
Pit 1	none	Lead	not monitored

$^{+}$ Concentration measurement(s) of 5 times greater than site-specific upper tolerance limits (UTL).
$^{++}$ Concentration measurement(s) of 10 times greater than site-specific upper tolerance limits (UTL).

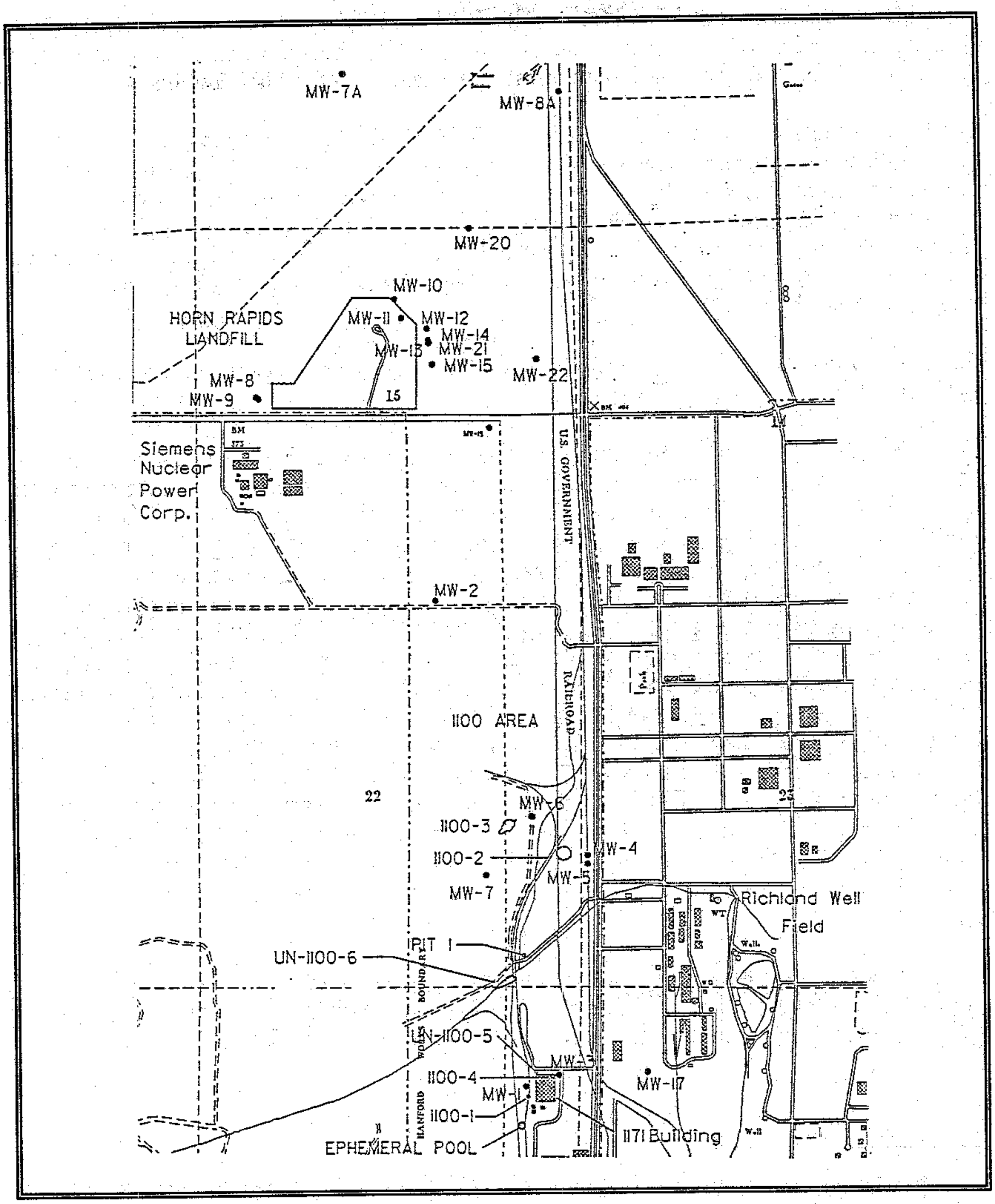

Figure 2. Correlation of Location of Operable Subunits, Horn Rapids Landfill, Seimens Nuclear Power and Existing Monitoring Wells at 1100-EM-1.

The data establishes that surface soil contamination does exist in specific subunits, (see table 1 and figure 2). However, the groundwater contamination does not correlate with the known surface and subsurface contamination at HRL or at the 1171 Building.

1.3.2 Involvement of a Potentially Responsible Party--DOE-RL has accepted responsibility for the characterization of a contaminant groundwater plume suspected to originate from process waste lagoons on property owned by Siemens Nuclear Power Corporation (SNP) containing levels of dissolved ammonia, sulfate, fluoride, and some nitrate. Water quality samples obtained at the SNP facility have verified the existence of the chemically contaminated groundwater[2] plume. SNP is hydrologically upgradient and in close proximity to the HRL.

1.3.3 Groundwater Contamination at HRL--The groundwater contamination at HRL is summarized in the following paragraphs:

- Gross ß: In order to determine if the gross ß is out of compliance (above the MCL), it is necessary to identify the radiochemical contaminant(s) present in the groundwater since this MCL is specified in energy units (4 mrem total body or internal organ annual dose). Current data suggests that a weak ß emitter, technetium-99 (^{99}Tc), is responsible for the gross ß. However, the body of radiochemical data for the groundwater at HRL is anomalous. The measurement of gross ß has consistently yielded values of approximately 100 pCi/L in groundwater at wells MW-10, 11, 12, 13, and 14. The quantitation of ^{99}Tc by an analysis specific for this isotope yielded values averaging approximately 3,000 pCi/L; the method was, however, rather insensitive with an error of $\pm$ 1,700 pCi/L. Pacific Northwest Laboratories (PNL) is currently analyzing groundwater, collected in September and November, 1991, specifically for the presence (and concentration, if present) of ^{99}Tc. PNL is using a more sensitive methodology. The methodology for future groundwater radionuclide analyses will depend upon the results from PNL regarding the presence of ^{99}Tc. If ^{99}Tc is present, it must also be determined if the gross ß contamination can be explained solely by the ^{99}Tc concentration. If this isotope is responsible for only a fraction of the gross ß, then additional analyses will need to be performed to identify the other ß emitting isotopes[3].

- Nitrate: Table 2 shows data quantifying the nitrate concentrations in the groundwater both upgradient and at HRL for six sampling rounds. These contaminants are present at other Operable Subunits at 1100-EM-1, but at concentrations approximately 10

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[2] *Groundwater Quality and Flow Characteristics in the Vicinity of the Exxon Nuclear Company, Inc. Fuel Fabrication Facility, Richland, WA.*

[3] The potassium concentrations on the site are approximately 10^3 μg/L. The natural abundance of potassium-40 (^{40}K) is 0.012%; therefore, approximately 8.5 pCi/L of ß emission can be attributed to naturally occurring ^{40}K that would not be considered a contaminant.

times lower than the average nitrate concentrations measured at HRL. These data indicate the presence of a groundwater nitrate plume extending beneath HRL.

Table 2. Nitrate Groundwater Plume at HRL

GROUNDWATER NITRATE CONCENTRATION AT HRL in mg/L (MCL = 10 mg/L)						
Wells Upgradient to HRL						
Well Number	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
MW-2	3.5	2.4	3.3	3.3	N/R	0.06 U
MW-7	2.3	2.1	2.3	2.1 J	N/R	3.5
Wells at and Downgradient to HRL						
Well Number	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
MW-10	38.6	36.8	42.0	38.1	39.1	37.9
MW-11	40.6	40.4	47.6	46.5	41.3	46.0
MW-12	49.0	49.0	56.7	50.8	50.1	49.0
MW-14	48.5	50.8	60.9	49.9	47.0	47.0
MW-15	32.3	32.1	44.2	30.9	30.0	N/R
6-S29-E12	N/R	4.5	4.6	3.8	N/R	N/R

N/R ≡ not reported or not yet available.

- Trichloroethylene: Table 3 presents the TCE concentration data for six groundwater sampling rounds at HRL. The data is clear evidence for a groundwater TCE plume. The source of the plume is not yet clearly defined.

The composition of the waste buried at HRL is not clearly known. Anecdotal reports indicated the possibility of drums of TCE buried at HRL. If drums of TCE had been buried on the site, and if these drums were/are leaking, then the plume of TCE in the groundwater could be explained by an onsite source. To explore this possibility, a series of geophysical studies was conducted. At the locations where the largest geophysical anomalies were observed, trenching was performed during October and November 1991. No intact drums of any kind were found, thus the source of the TCE contamination remains undetermined.

1.3.4 Background Levels--Proper assessment of background levels depends upon having samples from monitoring wells at sites where the surface and subsurface soils are known to be unaffected by contamination[4] in addition to the ability to quantify the analytes of concern.

[4] The determination of site-wide background levels is the subject of an extensive WHC study. The results from this study, when available, could be very useful and will be incorporated into the 1100-EM-1 RI/FS study as appropriate.

If these analytes are not detected, then default background levels are set at instrumental detection limits. The detection limits and quantitation limits are usually targeted at approximately 10 percent and 20 to 50 percent, respectively, of the MCL for a particular contaminant of concern.

Table 3. TCE Groundwater Plume at HRL

GROUNDWATER TCE CONCENTRATION AT HRL in μg/L (MCL = 5 μg/L)						
Wells Upgradient to HRL						
Well Number	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
MW-2	1 U	1 U	1 U	2 U	N/R	N/R
MW-7	1 U	1 U	1 U	2 U	N/R	1 U
MW-8	1 U	1 U	1 U	2 U	N/R	N/R
Wells at and Downgradient to HRL						
Well Number	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
MW-10	1	2	2	2 U	5 U	2 J
MW-11	1 J	3	2	3	5 U	3 J
MW-12	92 D	110 D	80	74	79	78
MW-14	40	73	60	66	82	75
MW-15	84	80	82	59	60	62
6-S29-E12	N/R	1 J	1 J	1 J	N/R	5 U

U ≡ Undetected at the concentration listed.
D ≡ Dilution required as sample concentration was above optimal range.
N/R ≡ Not recorded or not yet available.
J ≡ Estimate, qualitatively but not quantitatively correct.

MCL's are set by EPA in response to current toxicological data, both human and environmental. As the information data base grows, the list of regulated contaminants and their MCL's changes correspondingly. In responding to the new/proposed MCL's, DOE-RL has the opportunity to demonstrate a proactive history of compliance. In addition, by lowering quantitation limits for proposed MCL changes it will be possible to avoid unnecessary sampling events in the future.

1.3.5 New/Proposed MCL's--New or proposed MCL's relevant to 1100-EM-1 are listed below:

a) Effective July 30, 1992, EPA is scheduled to reduce the MCL for cadmium from 10 μg/L to 5 μg/L. In the absence of a measured site-wide or Operable Unit specific background cadmium concentration, the background concentration was arbitrarily set at 5 μg/L (the quantitation limit of the methods used) in the Interim Groundwater Summary Report. As of August, MCL's will be equivalent to this arbitrary background concentration implying that cadmium concentrations are at or out of compliance. At 1100-EM-1 cadmium has not been detected in the groundwater at concentrations at or above 3 to 5 μg/L, the instrumental detection limits of the methodology currently utilized (inductively coupled plasma atomic emission spectroscopy). In anticipation of new MCL's, USACE plans to lower the quantitation limit to 1.0 μg/L and the detection limit to 0.5 μg/L (using graphite furnace atomic absorption spectroscopy). Cadmium is known to bioaccumulate in both flora and fauna; therefore, this data may be useful for the risk assessment (for both human and environmental considerations).

b) Proposed on July 25, 1990, but not yet finalized by EPA, beryllium and thallium have been added to the list of regulated inorganics in drinking water. The proposed MCL's are 1 μg/L and 1 to 2 μg/L, respectively. The instrumental quantitation limits of the methods utilized to analyze groundwater concentrations of these elements at 1100-EM-1 are at or above the proposed MCL's. Since both elements were detected in the soils at HRL, an instrumental method with lower quantitation limits should be utilized such as graphite furnace atomic absorption spectroscopy.

c) Nickel concentrations in drinking water are currently not regulated by the EPA. However, an MCL of 100 μg/L for nickel was proposed July 18, 1991, but not finalized by EPA. Groundwater monitoring wells in the vicinity of the 1171 Building show some evidence of elevated values, near or slightly above the proposed MCL, for this contaminant. It is necessary to know the nickel concentrations around the 1171 Building with greater precision.

1.3.6 Possible Nickel Contamination at the 1171 Building--A graph showing the relationship between the nickel concentration and the proposed MCL for nickel is illustrated in figure 3. The open symbols represent concentrations of total dissolved nickel (filtered) and the solid symbols represent concentrations of total nickel (unfiltered) in μg/L.

The data is inconclusive and is considered to be weak evidence for nickel contamination; data for rounds 1 and 6 contain the laboratory qualifier "U," indicating that these data must be interpreted as "undetected at (or less than) the concentration listed."

1.3.7 Concentration of Micronutrients--The groundwater concentrations of both dissolved (filtered) and total (unfiltered) micronutrients such sodium, calcium, magnesium, iron, sulfate, carbonate, chloride, *etc.*, are well established. This data is useful for the FS but not the risk assessment. The available data is sufficient for the FS: therefore, future sampling rounds will not focus on the micronutrients. Table 4 shows examples of data from four (of eight total) rounds.

1.3.8 Total Dissolved Metals Versus Total Metals--Metals are known to exist in the groundwater in two forms: as dissolved ions and as colloidal suspensions. It has long been

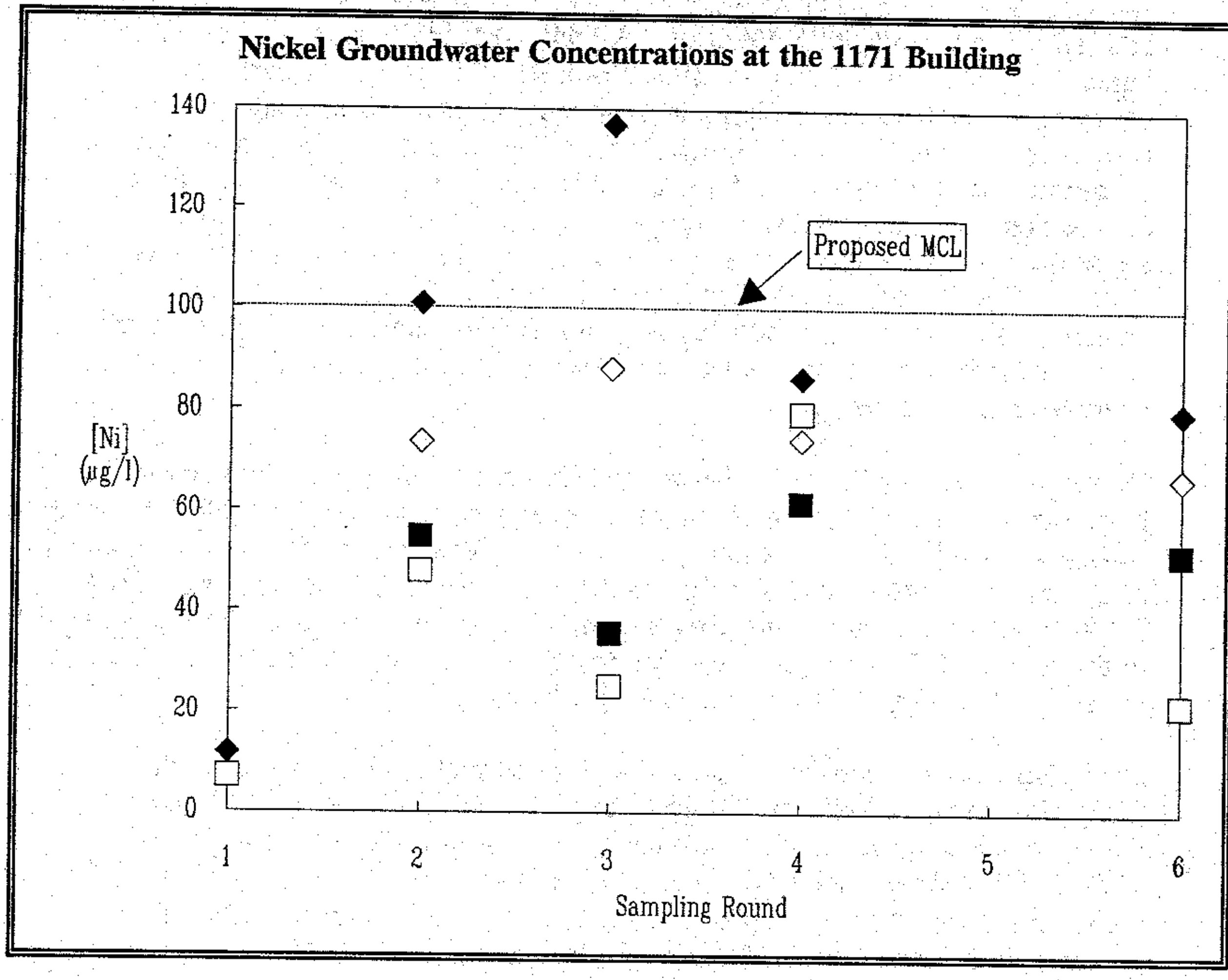

Figure 3. Filtered (□, ◇) and Unfiltered (■, ◆) Nickel Concentrations at MW-1 (◇, ◆) and MW-3 (□, ■).

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thought that only the dissolved fraction was mobile. In order to differentiate the dissolved (mobile) fraction from the colloidal (immobile) fraction both filtered and unfiltered groundwater samples are routinely obtained and analyzed. New data is now available[5] which suggests that dissolved metals are not a good indicator of the mobile fraction in groundwater. In light of this new information from EPA, it is appropriate to reevaluate the need to obtain both filtered and unfiltered groundwater samples.

It is necessary to obtain filtered samples if the well screens and filters have been improperly installed. Before obtaining groundwater samples several well volumes are pumped out of the well. If the well is constructed below acceptable standards, considerable sediment is pulled into the well during the pumping phase and remains suspended in the

[5] EPA, 1989, *Groundwater Sampling for Metal Analyses*, EPA/540/4-89/001, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

volume of water collected for the purpose of sampling. This particulate matter is not representative of the groundwater and can be the source of a large sampling error. However, all the wells designated with a MW label have been constructed within the last two years using modern construction techniques. Table 4 shows that the concentrations of sodium, calcium, and magnesium, in unfiltered groundwater is generally indistinguishable from the concentration of these cations in filtered groundwater for four wells. This data is interpreted as an indication that these wells were properly constructed.

Table 4. Examples of Concentrations of Selected Micronutrients

	MW-1 (mg/L)		MW-3 (mg/L)		MW-11 (mg/L)		MW-12 (mg/L)	
metal (Round)	dissolved	total	dissolved	total	dissolved	total	dissolved	total
sodium (1)	29.0	30.8	18.9	49.2	31.3	33.8	31.6	27.3
sodium (2)	24.9	24.8	40.7	34.4	32.7	33.0	32.9	32.8
sodium (3)	27.2	28.9	42.8	38.0	32.4	34.0	31.8	31.8
sodium (4)	24.3	24.5	44.5	47.4	30.8	31.4	30.5	31.7
calcium (1)	85.3	87.4	56.4	144	89.9	90.8	109	91.8
calcium (2)	64.4	64.4	125	104	96.7	96.5	116	115
calcium (3)	72.6	73.3	126	123	96.9	96.5	116	111
calcium (4)	71.4	72.1	136	138	101	99.2	106	107
magnesium (1)	18.5	18.9	12.9	18.9	18.5	19.3	23.2	19.5
magnesium (2)	14.2	13.9	27.6	13.9	21.2	21.1	23.9	23.8
magnesium (3)	15.1	16.0	28.7	16.0	22.0	22.4	24.2	22.6
magnesium (4)	15.2	15.4	29.3	15.4	21.9	22.7	22.4	23.5

U ≡ Undetected at the concentration listed.
J ≡ Estimate, qualitatively but not quantitatively correct.
B ≡ Analyte detected in laboratory blanks.

There are many possibilities of error introduction during filtration. The concentration of dissolved carbon dioxide and oxygen is low in groundwater, conditions that increase the solubility of many analytes. During sampling the groundwater is brought to the surface and into contact with these gases which may substantially lower the solubility of several contaminants. For example, iron is rapidly converted from the soluble ferrous ion (Fe^{+2}) to the insoluble ferric ion, (Fe^{+3}) upon contact with oxygen (the colloidal suspensions formed are known to entrap other heavy metals of interest); calcium may precipitate as calcium carbonate upon contact with CO_2. Examples of anomalous filtered and unfiltered data for iron is shown in table 5 below.

For the reasons presented above CENPW plans to collect only unfiltered samples.

Table 5. Examples of Filtered Versus Unfiltered Iron Concentration Data

	MW-1 (mg/L)		MW-3 (mg/L)		MW-11 (mg/L)		MW-12 (mg/L)	
metal (Round)	dissolved	total	dissolved	total	dissolved	total	dissolved	total
iron (1)	.051B	.227J	1.820J	2.81J	.074B	1.660J	.031B	.814
iron (2)	.035UJ	.305J	.106UJ	1.32J	.035U	.139	.046U	.388
iron (3)	.013U	.278	.013U	.177	.049U	1.390	.013U	.044U
iron (4)	.024U	.177	.035U	.301	.025U	.230	.044B	.041B

U = Undetected at the concentration listed.
J = Estimate, qualitatively but not quantitatively correct.
B = Analyte detected in laboratory blanks.

1.3.9 Monitoring for EPA's Target Analyte List--CENPW will retain responsibility for only those wells specified in tables 1 and 6 (in a subsequent paragraph). Monitoring strategy is to target a selected list of analytes that correspond to known soil or groundwater contamination. Responsibility for monitoring the remainder of the wells will be coordinated with Battelle's site-wide monitoring program. Continued monitoring for EPA's complete list of target analytes, target compounds, and groundwater quality parameters should continue at some frequency agreed to by DOE and the regulators. CENPW will coordinate closely with Battelle in order to: 1) avoid redundancy, 2) ensure all necessary data is collected, and 3) develop and implement a strategy for maintenance and/or closure of unnecessary or hazardous wells.

1.3.10 Summary--In conclusion, it is no longer necessary to define further the groundwater concentration of micronutrients such as sodium, calcium, iron, magnesium, sulfate, carbonate, chloride, *etc.*, as the concentrations of these analytes are now well established. It is also no longer necessary to maintain a quarterly groundwater monitoring schedule for the purpose of screening analytes that have consistently proven to be below action limits for more than 6 sampling rounds. It is more relevant and cost effective to use the analytical results from past sampling rounds to focus future efforts towards quantifying a selected subset of the target analyte list.

However, periodic testing for the full list of priority pollutant analytes should be performed in the event that levels of certain contaminants are increasing in groundwater that have historically been below quantitation limits. This testing is scheduled and will be coordinated with Battelle's site-wide monitoring group.

At specific sites where further characterization is necessary, such as HRL, the sampling frequency is dependent upon the data needs. An interactive and iterative process will be used (with data users such as risk assessors or the CENPW's Chief Counsel with regard to the potentially responsible party) providing input. Thus, future efforts will focus on filling identified gaps in the understanding of groundwater contamination at the site and on gathering information necessary to evaluate remedial alternatives. The data needs will be continually reevaluated in response to new data or new requirements for data. This document will be revised in the event of changes in the sampling and/or analysis strategy.

The details of this monitoring, including frequency and analytes, is presented in later paragraphs.

1.4 Scope

Requirements defined in this QAPjP document apply to all planned activities involving the sampling and analyses of groundwater at the 1100-EM-1 Operable Unit at the Hanford Facility performed in support of DOE-RL, and all contractors or organizations performing such activities for CENPW. Specifically, these requirements apply to the U.S. Army Corps of Engineers, Missouri River Division (CEMRD) with respect to all activities attributed to them in ER-1110-1-263 (Chemical Data Quality Management for Environmental Measurements), including EM-1110-1-XXX (DRAFT - Validation of Contract Analytical Chemical Laboratories). In addition, these requirements apply to all Contractors of CENPW performing activities associated with 1100-EM-1 Operable Unit groundwater monitoring, specifically, James M. Montgomery, Consulting Engineers Inc., their Subcontractors and Representatives.

1.5 Task Descriptions

CENPW does not anticipate any requirement for further field activities at this time beyond groundwater monitoring. The scope of this QAPjP is limited to data evaluation, report preparation, planned groundwater monitoring, and accompanying analytical services. This scope enables the critical groundwater monitoring to continue while not impacting the ongoing evaluation of existing data, completion of analytical work on previously collected samples, and development and finalization of deliverable reports as identified in *Remedial Investigation Phase 2 Supplemental Work Plan for the Hanford Site 1100-EM-1 Operable Unit* (DOE/RL-90-37, Revision 1). All field tasks except for groundwater monitoring were completed by December 1991.

In the Supplemental Work Plan the investigations are subdivided into nine tasks and a number of activities with individual task scopes described in detail in chapter 4.0, sections 4.2 through 4.11. Procedures applicable to the tasks described therein are identified in chapter 4.0 and appropriate appendices. Revision 2 of the Supplemental Work Plan provides a general discussion and definition of all work planned and/or conducted with a current schedule, including the work discussed in this QAPjP. All appropriate data will be evaluated, as it becomes available. If, after evaluation, additional fieldwork is deemed essential for <u>specific</u> purposes (such as additional data for the FS or risk assessment), this fieldwork will be described under a separate cover.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 District Commander

The U.S. Army Corps of Engineers, Walla Walla District Commander, is responsible for ensuring that a quality assurance (QA) program is established and implemented. The specific responsibilities for the program are listed in paragraphs 2.2.4.1.1 and 2.3.4.1 of the CEQAPP.

2.2 Organization

The specific responsibilities of personnel within the CENPW organizational structure pertaining to this Phase II RI/Phase III FS for the 1100-EM-1 Operable Unit are outlined in the following paragraphs. Effective identification, determination, achievement, and verification of product quality will be facilitated through clear assignment of responsibility, authority, and accountability at appropriate levels within the CENPW organization. The line organization responsibility for the quality achievement and quality verification of the Phase II RI/Phase III FS is as shown in figure 4. Figure 4 also shows the independent line organization responsible for quality assessment, *i.e.*, Special Assistant for Quality Assessment. The Project Manager/Technical Manager Team organization is shown in figure 5.

2.2.1 Project Manager--The Project Manager (PM) is responsible for managing the project parameters: scheduling, cost, scope, reporting, document control, and quality, as well as dealings and relationships with those involved in the project process (DOE-RL, WHC, CENPD, CEMRD, and CENPW). The PM is responsible for the delivery of the project on time and within budget. The PM will document the quality criteria and requirements for the project in coordination with DOE-RL and District Technical Managers as outlined in paragraph 2.3.4.5 of the CEQAPP. The PM is responsible to assure that all documents required for the project are maintained and controlled. These documents shall be available in the project office.

2.2.2. Engineering Division--The responsibilities of the Chief, Engineering Division, are outlined in paragraph 2.2.4.2.1 of the CEQAPP.

2.2.3 Special Assistant for Quality Assessment (SAQA)--The SAQA is an independent functional element necessary to provide QA planning, monitoring, and assessment as described in paragraph 2.2.4.1.3 of the CEQAPP. SAQA also provides QA oversight of CENPW organizations and other organizations CENPW will utilize to accomplish the preparation of the RI/FS report for the 1100-EM-1 Operable Unit. SAQA has appointed a senior staff engineer for ensuring the collection of valid Measurement Data and the routine assessment of Measurement Systems for precision and accuracy.

In addition to the responsibilities defined above, SAQA has the authority to stop work in the event that minor problems are not addressed in a timely manner or that major problems are not resolved. Stop work authority is further defined in paragraph 2.6.

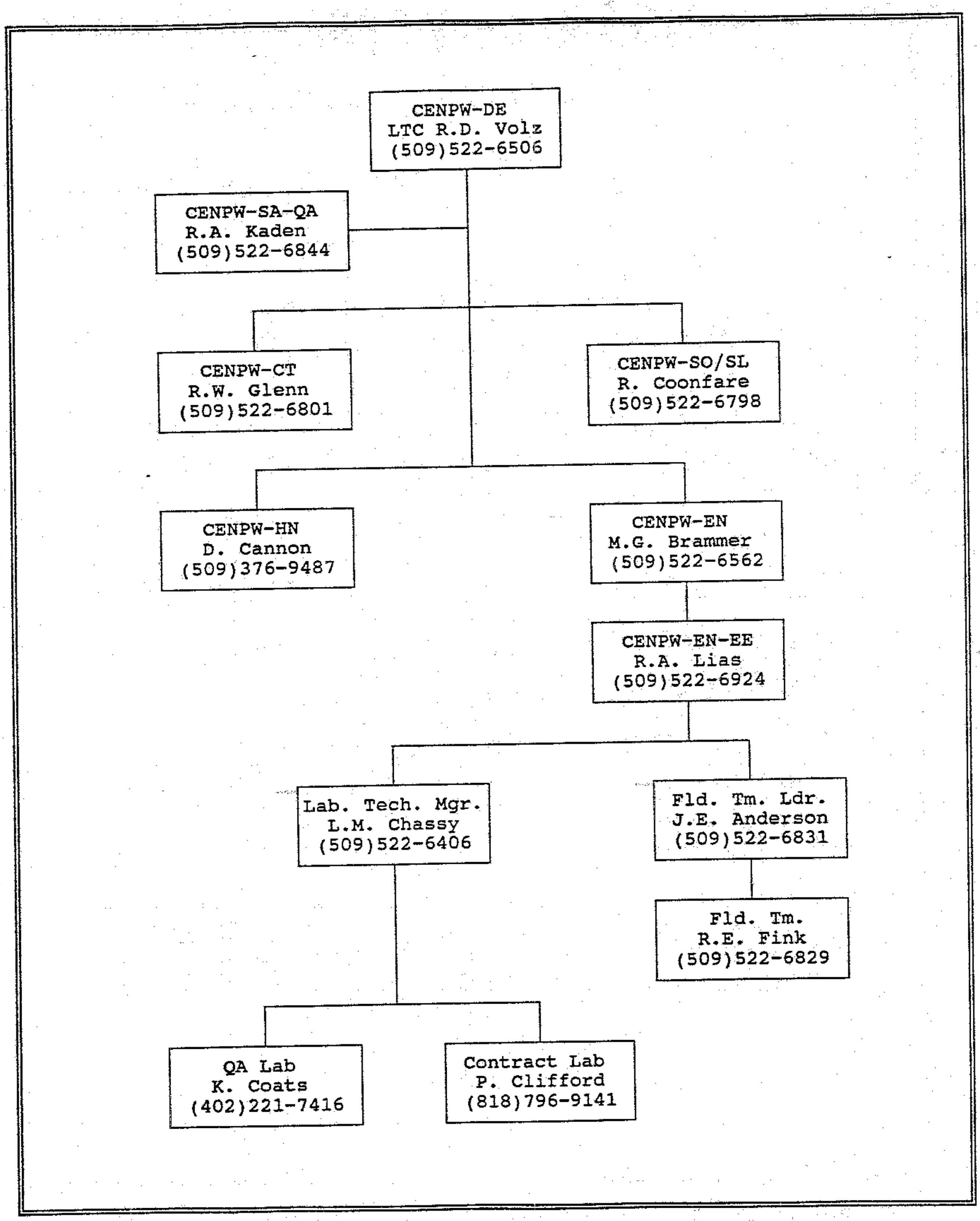

Figure 4. Quality Assurance Project Plan Line Organization Chart.

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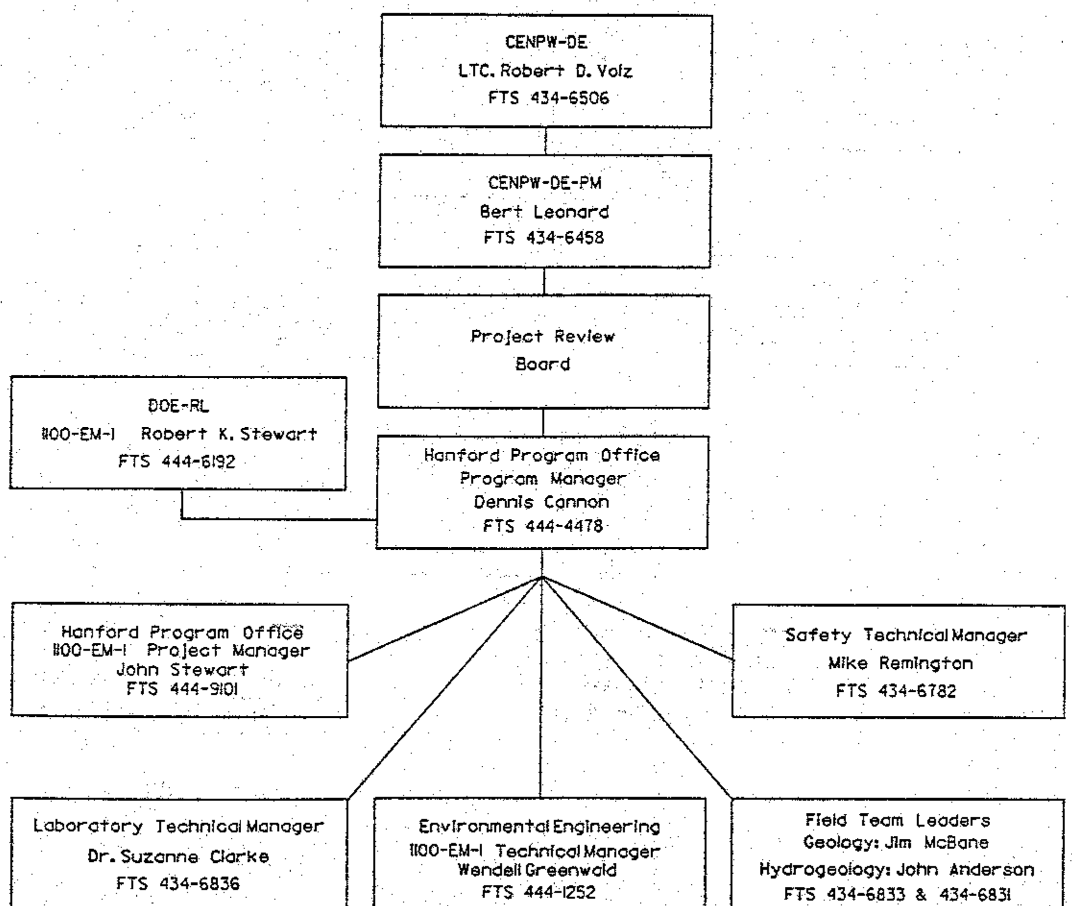

Figure 5. CENPW Project Manager/Technical Managers Organization Chart.

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2.2.4 Environmental Engineering Branch--The functions and responsibilities of the Chief, Environmental Engineering Branch, are outlined in paragraph 2.2.4.2.3 of the CEQAPP.

2.2.5 Safety and Occupational Health Office--The functions and responsibilities of the Safety technical manager are outlined in paragraph 2.2.4.1.2 of the CEQAPP.

2.2.6 Technical Manager--The functions and responsibility of the technical manager are defined in paragraphs 2.2.4.2.3e and 2.3.4.6 of the CEQAPP.

2.2.7 Laboratory Technical Manager--The Laboratory Technical Manager will be responsible for the quality achievement and quality verification of laboratory environmental data during preparation of the RI/FS. These activities are spelled out in paragraph 2.2.4.2.3 of the CEQAPP. The Laboratory Technical Manager is responsible for interface with CEMRD and also provides technical direction to the subcontracted laboratories.

2.2.8 Field Sampling Team--The CENPW field sampling team is responsible for ensuring that all sampling activities are carried out according to the protocols and QA standards defined in this document, the accompanying FSP, and paragraph 2.2.4.2.3f of the CEQAPP. This responsibility may be discharged as an oversight role if the sampling is accomplished by a Contractor to CENPW. At a minimum, 65 percent of all field sampling activities will be performed under the observation of one or more members of the CENPW technical staff.

The screening of all samples for radioactivity (and separating samples into two groups) for further analysis will be performed by (or under the direction of) the CENPW Health and Safety Technical Manager. Samples with levels of radioactivity exceeding 200 counts/minute (or "background") as detected by standard field survey equipment (specified in the FSP and SSHP), will be routed to a Hanford Site participant laboratory that is equipped and qualified to analyze radioactive samples. Samples exhibiting levels of radioactivity exceeding background will not be released to an offsite laboratory based on field measurements, but will be routed to an onsite laboratory (in either the 200 or 300 area), measured with laboratory radioanalytical equipment, and then released in accordance with CENPW procedures and in compliance with the DOE-RL shipping regulations as defined below. (It is anticipated that no groundwater samples from 1100-EM-1 will exceed background based on data from more than 6 sampling rounds.)

Shipped materials (in accordance with current DOE-RL limits for shipment of radiological materials) must have activity levels less that those stated below:

- 1.0 mR/hour at surface contact of sample.
- 100 nCi/gram total activity (β and γ).
- 10 nCi/gram total α activity.

No transuranium waste will be shipped offsite. The current definition of transuranium waste is "without regards to form, waste with > 100 nCi/gram alpha-emitting transuranium radionuclides with half-lives greater than 20 years."

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The surveillance controls invoked by the CEQAPP are applicable to all offsite laboratory operations. Applicable quality requirements for CEMRD-laboratory, Subcontractors, or participant Contractors will be invoked as part of the approved procurement documentation or work order as noted in paragraph 4.1.2. The QA program plans and applicable analytical procedures will be approved by CENPW in accordance with chapter 21 of the CEQAPP for both the governmental QA laboratory (CEMRD-laboratory) and the proposed contractor laboratory (J.M. Montgomery Laboratory, Pasadena, California).

2.3 Interface with Other USACE Organizations

Interface with other USACE Organizations is covered in paragraph 2.4.1 of the CEQAPP. The Laboratory Technical Manager is responsible for interface with CEMRD.

2.4 Interface with USACE Contractors

Interface with contractors is outlined in paragraph 2.4.2 of the CEQAPP. The Administrative Contracting Officer (ACO) will be as defined in the contract documents.

2.5 Indoctrination, Training, and Qualification

All personnel used by CENPW, other USACE organizations, and USACE contractors will receive the training required by CEQAPP paragraphs 3.5.1.1 and 3.5.1.2. The personnel will be indoctrinated with subject material in paragraph 3.5.2.1 of the CEQAPP. The supplemental training required by paragraphs 3.5.2.4b and c of the CEQAPP will be given to those individuals participating in the groundwater monitoring activities.

2.6 Stop Work Authority

The stop work authority outlined in paragraph 2.5 of the CEQAPP applies to all work covered by this QAPjP.

2.7 Delegation of Work

The District Commander and Special Assistant for Quality Assessment are responsible for establishing and executing the QAP and shall retain authority for any work delegated to others. Quality assurance functions delegated to others will be described in writing.

3.0 DATA QUALITY OBJECTIVES

Analyses performed on 1100-EM-1 groundwater samples will use standard EPA reference methods. Target values for quantitation limits, precision, and accuracy must be adjusted and/or confirmed and accepted by the designated QA laboratory (CEMRD-laboratory), the proposed contractor laboratory (J.M. Montgomery Laboratory), and CENPW before final approval of associated subcontracts or work orders. Once these values are established as contractual requirements in compliance with standard procurement procedures (see paragraph 4.1.2), the QAPjP and FSP will be updated, if necessary, to reference approved quantitation limits, precision, and accuracy criteria as project requirements. All changes will be documented and submitted to DOE-RL and the regulators for approval.

Goals for data representativeness are addressed qualitatively by the specifications of well locations and well purging in the FSP. Proper sample handling procedures such as sample preservation, use of appropriate bottles, and proper sampling techniques will also contribute to the representativeness of samples.

USACE policy is to contractually require completeness levels of 95 percent. Completeness includes all contractual deliverables such as procedurally established requirements for precision and accuracy; internal QC (method blanks, duplicates/matrix spike duplicates and surrogates such that the data accuracy and precision can be assessed); CLP-type data package; and laboratory data verification. The target quantitation limits are those established by EPA and are specific to both analyte and methodology. Failure to meet these quantitation limits due to matrix effects must be substantiated by the contractor laboratory.

Failure to meet these criteria will be evaluated in the data assessment process described in paragraph 12 and will be subject to any necessary corrective actions as discussed in paragraph 13. Approved analytical procedures will require the use of reporting techniques and units specified in EPA reference methods in this QAPjP to facilitate the comparability of data sets in terms of precision and accuracy.

Two different project specific levels of effort are defined, each relevant to the needs of the data use. Table 6 correlates specific locations at 1100-EM-1 with the monitoring wells to be sampled, the frequency of sampling, and the tables defining the QA objectives for the accuracy, precision, and completeness of the analytical data.

3.1 Water Quality Monitoring with Involvement of a Potentially Responsible Party

3.1.1 Groundwater Contamination at HRL--Further characterization of the groundwater contamination at Horn Rapids Landfill is necessary. A possible potentially responsible party (SNP) is involved[6]. The indicator contaminants are nitrate, TCE, fluoride, possibly titrated water, and elevated gross ß (suspected contaminant is ^{99}Tc). The inorganic and volatile organic concentrations can be quantified using standard methodologies equivalent to EPA's level IV. The radionuclide(s) can only be quantified using special analyses equivalent to EPA's level V. The sampling dates will be synchronized with those of SNP for the purpose

[6] The documentation necessary is substantial when a potentially responsible party is involved. If CENPW is to be the custodian of any original records the following precautions, as described in the disposition clauses of NQA-1 will be taken: all original records pertaining to the case (field sampling logs, chain of custody forms, original raw data, laboratory notebooks, validation records, *etc.*) will be protected from fire by storage in a fireproof cabinet within a fireproof vault (CENPW's "Map Room").

of comparability. The months that sampling events will occur are projected by SNP[7] to be: March, May, and August (1992). A list of the specific wells to be monitored is given in table 6, the location of these wells is shown in figure 2, and the analysis methods and parameters are given in tables 7 and 8.

Table 6. Correlation of Specific Wells with Monitoring Frequency and Chemical Analyses

Well	Nearest Operable Unit	Frequency of Monitoring	Corresponding Table
MW-1	1100-1 & Ephemeral Pool	Annual	8
MW-3	1100-4 & UN-1100-5	Annual	8
MW-4	1100-2	Annual	8
MW-6	1100-3	Annual	8
MW-7	None; samples used for background.	whenever needed	as appropriate*
MW-8	HRL	quarterly	7*
MW-10	HRL	quarterly	7*
MW-11	HRL	quarterly	7*
MW-12	HRL	quarterly	7*
MW-14	HRL	quarterly	7*
MW-15	HRL	quarterly	7*
MW-19	downgradient from HRL	quarterly	7*
MW-20	downgradient from HRL	quarterly	7*
MW-22	downgradient from HRL	quarterly	7*
6-S29-E12	downgradient from HRL	quarterly	7*

* The May quarterly sampling effort requires measurement of analytes indicated in Tables 7 and 8.

As required by ER-1110-1-263, all projects that are conducted in-house or by USACE contractor are to include duplicates and field blanks at a 5- to 10- percent rate for the contract laboratory as QC samples and splits and field blanks at the same rate for the QA laboratory as QA samples. Since a potentially responsible party is involved, a 10 percent rate will be utilized for the analytes of concern (common anions and volatile organics). The data validation will be performed by a contractor, using methodology as described in the document prepared by Golder Associates under contract to WHC: *Data Validation Procedures for Chemical Analyses*, Draft-4/92 (or latest approved revision), and *Data Validation Procedure for Radiological Analyses*, Procedure X.X, Revision 0, WHC, June 18, 1991. This methodology is similar to EPA's *Functional Guidelines Data Validation for CLP.*

[7] The projected dates are from figure 11, "Preliminary Schedule for Phase I Study;" *Work Plan, Phase I Groundwater Study, Siemens Nuclear Power Corporation*, September 19, 1991, Richland, Washington.

3.2 Water Quality Monitoring Indicated from Groundwater Data and Surface and Subsurface Soil Contamination.

3.2.1 Possible Groundwater Contamination at 1171 Building--The nickel concentrations in the groundwater near the 1171 Building are near (slightly above or below) EPA's MCL for this element. There is no known onsite nickel source. Data with sufficient precision and accuracy is needed to determine if concentrations are increasing over time. This could indicate groundwater contamination from contaminated soils (source unknown). We can obtain the precision and accuracy necessary from duplicates, matrix spike duplicates, and replicates.

3.2.2 Annual Groundwater Monitoring to Detect if Soil Leachates Affect Water Quality--Known surface and subsurface soil contamination exists at 1100-EM-1. The analytes of concern are specific to each operable subunit and summarized in table 1. Monitoring for all contaminants listed in table 8 will occur annually.

The data quality objectives are to obtain usable data of sufficient precision and accuracy to detect changes in groundwater quality. In order to evaluate the data quality, all original data (laboratory verified) will be requested in a package comparable to EPA's level IV CLP (full validation would be possible, if relevant and necessary). The data will then be reviewed in-house, with special attention given to concentration values that differ from previous sampling rounds.

3.3 Water Quality Monitoring - Full Screening for EPA's Target Analyte/Target Compound List

Full screening as described in the work plan (DOE/RL-90-37(Rev. 1)) will be coordinated with Battelle's site-wide monitoring group at a frequency agreed to by the three parties of the TPA (DOE, EPA, Washington State Department of Ecology). All wells retained by CENPW will be monitored annually for all analytes listed in EPA's Target Analyte/Target Compound list.

4.0 SAMPLING PROCEDURES

It is the national policy of USACE to adopt EPA methodology whenever appropriate. CENPW will utilize methodology specified in the *Compendium of Superfund Field Operations Methods* (EPA, September 1987). As necessary, these methodologies will be modified to incorporate all applicable and appropriate requirements specific to activities at Hanford. These methods are specified in the accompanying FSP.

4.1 Procedure Approvals and Control

4.1.1 CENPW Procedures--All procedures are listed in the FSP and will be approved by DOE-RL and the regulators.

4.1.2 Contractor Laboratory Procedures--As noted in paragraph 2.1, contractor services will be procured, under CENPW procedures. Whenever such services are required, requirements for review and approval of all applicable procedures will be included in the procurement document or work order, as applicable. In addition to the submittal of analytical procedures, analytical laboratories will be required to submit the current revision of their internal QAPP. Prior to use, all analytical laboratory plans and procedures will be reviewed and approved by qualified personnel, as directed by the Laboratory Technical Manager in accordance with the CEQAPP and ER-1110-1-263. All contractor laboratory procedures, plans, and/or manuals will be retained as project quality records in compliance with chapter 18 of the CEQAPP. All documents will be made available for regulatory review and approval as secondary documents (per TPA).

4.1.3 Procedure Change Control--It must be recognized by all that investigation and characterization work of unknown conditions requires flexible planning so that as new information is discovered, existing plans can be easily modified to account for the new information. Deviations from established procedures that may be required in response to new or unforeseen field situations must be authorized. The majority of changes anticipated will be minor and will be documented in the daily field log book. Other substantive changes will be submitted to the DOE Unit Manager and appropriate regulatory personnel at Unit Manager meetings for approval. The Unclassified Document Control Form, included as part of the work plan, will provide the requisite listing/control of authorized procedures.

4.2 Sample Identification, Location, and Frequency

The sample identification described in Environmental Investigation Instruction (EII) 5.10, *Sample Identification and Data Entry into the HEIS Database* (WHC 1989c) was used to designate completed samples obtained during field activities of the Phase II RI. CENPW will follow this EII to maintain site-wide sample identification consistency.

4.3 Sample Container Preparation, Handling, Preservation, and Shipping

Sample container selection, preparation, and preservation for completed sampling operations are to be conducted as specified in ER-1110-1-263, as appropriate for the type of sample involved. All samples must be packaged and shipped in compliance with the applicable requirements of ER-1110-1-263, following chain-of-custody documentation as described in paragraph 5.0. All radioactive and/or hazardous samples will be shipped following all applicable and relevant DOE orders and Nuclear Regulatory Commission and Department of Transportation regulations.

4.4 Sampling Equipment Decontamination

Field support equipment and sample acquisition equipment are to be cleaned and decontaminated prior to use as described in the FSP.

5.0 SAMPLE CUSTODY

Sample custody is a vital aspect of groundwater monitoring studies because the data generated may be used as evidence in a court of law. The samples must be traceable from the time of sample collection until the time the data are introduced as evidence in legal proceedings[8]. All samples obtained during the course of this investigation are to be controlled from point of origin to the analytical laboratory. Laboratory chain-of-custody procedures will be reviewed and approved in compliance with the requirements of ER-1110-1-263 and paragraph 4.1, as applicable. These procedures will ensure the maintenance of sample integrity and identification throughout the analytical process. Results of analyses will be traceable to the original sample through a unique numerical sample identifier discussed in chapter 4.0 and table 2 of appendix A of (DOE/RL-90-37). All analytical results will be controlled as permanent quality records as required by chapter 18.0 of the CEQAPP.

All samples will remain in the custody of the sampling personnel during each sampling day. At the end of each sampling day and prior to the transfer of the samples, chain-of-custody entries will be made for all samples using chain-of-custody records as shown in the FSP. One chain-of-custody record will be completed for each cooler of samples. All information on the chain-of-custody record and the sample container labels will be checked against the sampling log entries; and, samples will be recounted before transferring custody. Upon transfer of custody, the chain-of-custody records will be signed by a member of the field team, sealed in plastic, and taped to the inside lid of each respective cooler. A signed, dated custody seal will be placed over the lid opening of each sample cooler to indicate if the cooler is opened during shipment. According to EPA's National Enforcement Investigations Center (NEIC), a sample is in a person's *custody* if:

- The sample is in the person's actual possession, or
- The sample is in a person's view, after being in their actual physical possession, or
- The sample was in their actual physical possession and then they locked it up to prevent tampering, or
- The sample is in a designated and identified secure area.

The laboratory, upon receipt of the samples, will be responsible for all chain-of-custody following their approved QAPP.

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[8] Jeffrey C. Worthington (Director of Quality Assurance), Kerri G. Luka (Audit Programs Manager), R. Park Haney Esq. (Vice President), TechLaw, Inc. 12600 W. Colfax Avenue, Suite C-310, Lakewood, Colorado 80215: *Factors Affecting the Admissibility and Weight of Environmental Data as Evidence*, Presented at the Seventh Annual Waste Testing and Quality Assurance Symposium, July 8-11, 1991, Washington, D.C.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

Requirements for calibration and standardization data records for each instrument and method are described in ER-1110-1-263. These records will include:

a. The date of last calibration.

b. The calibration history.

c. The frequency of calibration.

d. The outside sources of calibration, if used, *e.g.*, the manufacturer.

e. The date of preparation, the expiration date, and the name of person performing the preparation of standards.

f. The written procedures for instrument calibration.

Laboratory analytical equipment will be calibrated as specified by EPA for each instrumental method used (as defined in tables 7 and 8).

7.0 ANALYTICAL PROCEDURES

The contractor laboratory must be validated by CEMRD for all analytical methods identified in tables 7 and 8 in compliance ER-1110-1-263 and with appropriate CENPW procedures and/or procurement control requirements. Tables 7 and 8 provide general guidelines and reference sources for target quantitation limits and target values for precision and accuracy for each analyte of interest. Once individual laboratory statements of work are negotiated, and procedures approved in compliance with paragraph 4.1.2, this QAPjP and the accompanying FSP will be revised to include actual method references, approved contractual quantitation limits, precision, and accuracy criteria as project requirements; all such changes will be documented as required by the CEQAPP and submitted for regulatory review as secondary documents.

All analytical procedures approved for use in this investigation will require the use of standard reporting techniques and units to facilitate the comparability of data sets in terms of precision and accuracy. All approved procedures are described in tables 7, 8, and in the FSP.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 Data Interpretation and Analysis

All contractor analytical laboratories will be responsible for preparing a report summarizing the results of the analysis. The CEMRD-Laboratory, as the QA Laboratory (as defined in ER-1110-1-263), is responsible for preparing a Chemical Quality Assurance Report (CQAR) that includes identification of samples, sampling and analysis dates, raw analytical data, reduced data, data outliers, reduction formulae, recovery percentages, quality control check data, equipment calibration data, supporting chromatograms, or spectrograms, and documentation of any nonconformance affecting the measurement system in use during the sample analysis. Data reduction schemes will be contained within the attached laboratory analytical methods and/or QAPP. The completed data package will be reviewed and approved by the analytical laboratory QA manager before it is submitted to CEMRD-Laboratory for incorporation into the *Chemical Data Quality Report (CDQR)*. The flow-chart for analytical results is in figure 6.

8.2 Validation

The data validation will be performed by a Contractor using methodology described in paragraph 3.1.1.

8.2.1 Field Screening Analysis--Validation and Report Preparation Requirements-- Screening analyses (such as radiological screening) will be performed in compliance with CENPW-approved procedures, as noted in paragraph 4.1.

8.2.2 Standard Analysis--Validation and Report Preparation Requirements--All laboratory analyses will be evaluated for their usability. Formal, documented, validations will be performed on any and all data which may be used as evidentiary data.

8.2.3 Special Analysis--Validation and Report Preparation Requirements--Special analyses will be subjected to peer review when validation by the methodology cited in paragraph 3.1.1 is inappropriate or inadequate.

8.3 Final Review and Records Management Considerations

At the discretion of the CENPW PM, all verification records, validation reports, and supporting analytical data packages will be subjected to a final technical peer review before they are submitted to the regulatory agencies, or are included in reports or technical memoranda. All reports, data packages, and review comments will be maintained as permanent project quality records in compliance with chapter 18.0 of the CEQAPP. If the documents are to be released to the regulators (EPA and Washington State Department of Ecology) then procedures of NPW-H-OM 200-1-1, *Document Clearance* will be followed.

9.0 INTERNAL QUALITY CONTROL CHECKS

All analytical samples will be subject to in-process QC measures in both the field and the laboratory. The following minimum field QC requirements are necessary for data validation. These requirements are adapted from EPA (1986b), as modified by the proposed rule changes included in the *Federal Register*, 1989, Volume 54, No. 13, pp 3212-3228, and 1990, Volume 55, No. 27, pp 4440-4445.

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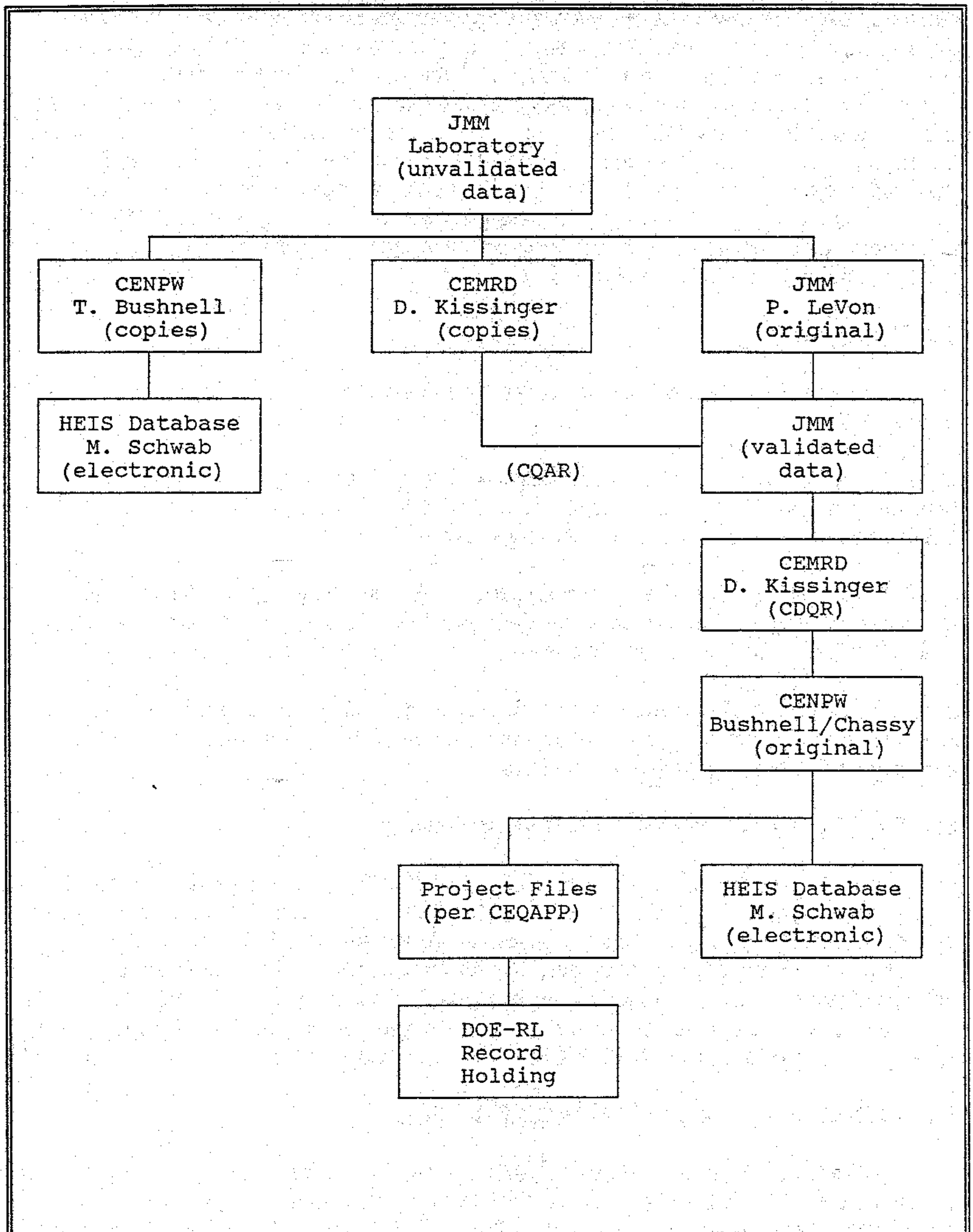

Figure 6. Flow-chart for Analytical Results from Laboratory

a. Field duplicate samples: For each shift of sampling activity under an individual subtask, a minimum of 10 percent of the total collected samples will be duplicated. Duplicated samples will be retrieved using the same equipment and sampling technique and will be placed in two identically prepared and preserved containers. All field duplicates will be analyzed independently as an indication of gross errors in sampling techniques.

b. Split samples: At the CENPW Laboratory Technical Manager's direction, field or field duplicate samples may be split in the field and sent to an alternate laboratory as a performance audit of the primary laboratory. Frequency will meet the minimum schedule requirements of paragraph 10.0.

c. Blind samples: At the CENPW Laboratory Technical Manager's direction, blind or double-blind reference samples may be introduced into any sampling round (in lieu of split samples) as a performance audit of the primary laboratory. Blind sample type and frequency will be as directed by the CENPW Laboratory Technical Manager; frequency will meet the minimum schedule requirements for performance of audits in paragraph 10.0.

d. Equipment blanks: Equipment blanks will consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures and will be collected at the same frequency as field duplicate samples.

e. Trip blanks: A sample of analyte-free media taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and handling procedures. This blank is useful in documenting contamination of volatile organic samples.

f. Method blanks: An analyte-free media to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank must be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

g. Temperature blank: One small polyethylene or glass container (minimum of 8 oz.) filled with water and clearly labeled "Temperature Blank" will be included within each cooler. The temperature will be measured and recorded immediately upon receipt of the cooler by the Contractor or QA laboratory. If the temperature is above $4° C \pm 2°$, the laboratory must immediately notify the CENPW laboratory manager or a designated representative.

h. Preservative blank: One extra sample container containing preservative (HCl, H_2SO_4, or HNO_3, as appropriate) will be supplied for each day of sampling. The bottles will be filled with the specified volume of groundwater and the pH tested with broad-range pH paper (or with a pH meter). If the pH is greater than two, then measured aliqouts of acid will be added until the pH is measured to be less than two. Additional volume of preservative (as determined above) will then be added to each sample container as needed. These blanks will not be shipped to the laboratory.

i. Sample collection blank: Environmental contamination (such as dust being blown into the sampling bottle during sampling) will be evaluated by filling two sample bottles per day with a distilled/deionized carboy in the field. The samples will be collected at a height above the ground similar to samples collected from the well and the bottles open for approximately the same length of time as samples from the well. As a control, one sample per day will be collected by filling the sample bottles in a clean area. The sample collection bottles will be collected for analyses of particular concern such as volatile organics, anions (NO_2^-, NO_3^-, PO_4^{3-}, F^-) and inorganics.

Internal QC checks for fully validated analyses will be as specified by the laboratory's approved QAPP and will meet the following minimum requirements:

a. Matrix spike/matrix spike duplicate samples: Matrix spike and matrix spike duplicate samples require the addition of a known quality of a representative analyte of interest to the sample as a measure of the recovery percentage and as a test of the analytical precision. The spike will be made in a replicate of a field duplicate sample. Replicate samples are separate aliquots removed from the same sample container in the laboratory. Spike compound selection, quantities, and concentrations will be described in the laboratory's approved analytical methods. One sample will be spiked for each analytical batch, or every 20 samples, whichever is greater.

b. QC reference samples: A QC reference sample will be prepared from an independent standard at a concentration other than used for calibration, but within the calibration range. Reference samples are required as an independent check on analytical techniques and methodology, and will be run with every analytical batch, or every 20 samples, whichever is greater.

The minimum requirements of this paragraph will be invoked in procurement documents or work orders, in compliance with standard CENPW procedures as noted in paragraph 4.1.

10.0 PERFORMANCE AND SYSTEMS AUDITS

Performance, system, and program audits will be conducted as outlined in chapter 19.0 of the CEQAPP. The audits will be scheduled to begin early in the execution of this work plan and continue through work plan completion. Collectively, the audits address quality affecting activities that include, but are not limited to, measurement system accuracy, internal and external analytical laboratory services, field services and data collection, processing, validation, and management.

In addition to audits by CENPW, the contract and QA laboratories should anticipate audits by DOE-RL which will include onsite audits and review of all Quality Assurance Programatic Documents.

11.0 PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field and laboratory that directly affects the quality of the field and analytical data will be subject to preventive maintenance measures that ensure minimization of measurement system downtime and corresponding schedule delays. Laboratories will be responsible for performing or managing the maintenance of their analytical equipment. Maintenance requirements, spare parts lists, and instructions are included in individual methods or in the approved laboratory QAPP. CENPW field equipment will be drawn from inventories subject to standard preventive maintenance procedures. Field procedures submitted for CENPW approval by participant contractors or subcontractors will contain provisions for preventive maintenance, maintenance schedules, and spare parts lists to ensure minimization of equipment downtime.

12.0 DATA ASSESSMENT PROCEDURES

As noted in section 4.9 of the Supplemental Work Plan, the data generated during the RI/FS will be monitored on an ongoing basis. Data evaluation summaries will be prepared and reported to the PM, Technical Manager (TM), and Laboratory TM on a monthly basis in order to facilitate any necessary redirection or emphasis of the characterization effort. Where data are generated in sufficient quantity to warrant such analysis, the PM, TM, or Laboratory TM may direct the application of specific statistical or probabilistic techniques in the process of data comparison and analysis. Such techniques are likely to include the calculation of tolerance limits, and the calculation of confidence limits, as directed in the following sections.

12.1 Tolerance Limit Calculations

Each hazardous substance has a certain background distribution in a given environmental medium. Before a substance can be regarded as a site-specific contaminant, it must be found to occur at concentrations exceeding (or for pH, lying outside) the local background distribution. Site-specific tolerance limits will be calculated to make these determinations in an objective manner.

All environmental-medium-specific background distributions will be assumed to be normal, unless non-normality can be demonstrated. One-sided tolerance limits corresponding to the 95th percentile of the background distribution, with a degree of confidence of 95 percent, will be calculated in accordance with the methodology provided in EPA (1989a). Two-sided tolerance limits corresponding to the 5th and 95th percentiles of the background distribution, with a degree of confidence of 95 percent, will be calculated for pH in accordance with the methodology provided in Miller and Freund (1965).

12.2 Confidence Limit Calculations

During a baseline risk assessment, reasonable maximum exposure concentrations and other factors are estimated. In accordance with EPA (1989b), reasonable maximum risk factors are calculated by substituting a mean value with a conservatively biased estimate of the mean. Such estimates are obtained from calculation of an upper and lower (whichever provide the conservative estimate) confidence limit of the distribution of the mean.

Mean value distribution used in exposure assessment will be assumed to be normal. One-sided, 95 percent confidence limits will be calculated in accordance with the methodology provided in Miller and Freund (1965).

13.0 CORRECTIVE ACTIONS

The requirements of chapter 17 of the CEQAPP will apply to CENPW, other USACE organizations, and USACE contractors.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The QA program shall provide for the periodic reporting of pertinent QA/QC information to management to allow assessment of the overall effectiveness of the QA program in accordance with paragraphs 3.6, 3.7, and 3.8 of the CEQAPP.

14.1 Report on Measurement Quality Indicators

This report will include an assessment of the QC data gathered over the period, the frequency of repeating work due to unacceptable performance, and the corrective action taken.

14.2 Report on QA Assessments

This report will be submitted immediately following any internal or external onsite evaluation or upon receipt of results of any performance evaluation studies. The report will include the results of the assessment and the plan for correcting identified deficiencies.

14.3 Report on Key QA Activities during the Period

A report will be delivered to management summarizing key QA activities during the period. The report will stress measures that are being taken to improve data quality and will include a summary of significant quality problems observed and corrective actions taken. The report will also include a summary of involvements in resolution of quality issues with agencies, QA organizational changes, and notice of the distribution of any revised documents controlled by the QA function (*i.e.*, SOP's, CEQAPP).

14.4 Chemical QA Report

The Chemical Data Quality Report prepared by the QA laboratory (CEMRD-Laboratory) is a report to management evaluating the performance of the contractor laboratory. This report will contain pertinent QA/QC information for management to allow the assessment of the overall effectiveness of the QA program within the laboratory.

15.0 REFERENCES

An index of the documents and procedures required to implement this Quality Assurance Project Plan.

APHA, 1985, *Standard Methods for the Examination of Water and Wastewater*, 16th Edition, American Public Health Association, Washington, D.C.

ASME, 1989, *Quality Assurance Program Requirements for Nuclear Facilities*, NQA-1, American Society of Mechanical Engineers, New York, N.Y.

ASTM, 1989, 1990, *Annual Book of ASTM Standards*, American Society for Testing and Materials, Philadelphia.

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DOE-RL, 1989, *Remedial Investigation/Feasibility Study Work Plan for the 1100-EM-1 Operable Unit Hanford Site, Richland, Washington DOE-RL 88-23*, U.S. Department of Energy, Richland, Washington.

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EPA, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses*, U.S. Environmental Protection Agency, Washington, D.C.

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EPA, 1989a, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C.

EPA, 1989b, *Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Part A, Interim Final*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

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APPENDIX C

FIELD SAMPLING PLAN

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9 2 1 2 7 5 5 0 6 6 2

9 2 1 2 7 5 0 6 6 3

LIST OF TABLES

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FIELD SAMPLING AND ANALYSIS PLAN

CONTINUATION OF PHASE II GROUNDWATER STUDY
1100-EM-1 OPERABLE UNIT
RICHLAND, WASHINGTON

1.0 SITE BACKGROUND

This Field Sampling and Analysis Plan (FSP) was prepared by the U.S. Army Corps of Engineers, Walla Walla District (CENPW), in conjunction with the Remedial Investigation (RI) Phase II Supplemental Work Plan for the 1100-EM-1 Operable Unit in Richland, Washington. The purpose of this FSP is to establish protocols and procedures for project organization, data quality objectives, and sample collection and analysis activities related to groundwater monitoring conducted during the implementation of the Work Plan. The FSP fulfills the requirements for sampling and analysis plans as specified by OSWER Directive 9355.3-01, October 1988 and OSWER Directive 9080.0-1, September 1986. The FSP was developed in conjunction with the CENPW Quality Assurance Project Plan (QAPjP). A detailed historical background, description of previous site uses, and elaboration of project rationale can be found in the other project documents including the Phase I RI report, the Phase I/II FS report, and both the Phase I and Phase II Supplemental Work Plans.

The majority of the field sampling and analytical efforts for the 1100-EM-1 Operable Unit have been completed. Some activities are incomplete (*e.g.*, analyses of previously collected samples). Procedures and protocols defined in this Field Sampling Plan and accompanying QAPjP do <u>not</u> supersede the procedures/protocols previously agreed upon in other project documents prepared by Westinghouse Hanford Company (WHC) (and/or its contractors). This includes, but is not limited to, documents such as the Supplemental Work Plan and any Environmental Investigation Instructions contained therein by word or by reference.

There are, however, some limited additional field sampling and analytical efforts that need to be undertaken for groundwater quality monitoring and further contaminant characterization. These efforts will be accomplished from December 1991 until the completion of RI activities.

2.0 SAMPLING OBJECTIVES

As introduced in the accompanying QAPjP, eight complete groundwater sampling events have occurred to date at 1100-EM-1. The strategy utilized for the monitoring was conservative in its scope, and included analyses for all EPA regulated target analytes and groundwater quality parameters. Only one site, Horn Rapids Landfill (HRL), shows clear evidence of groundwater contamination above EPA's maximum concentration limits (MCL) (the contaminants of concern being nitrate, trichloroethylene, and gross ß). One well near the 1171 Building shows inconclusive evidence for nickel concentrations near the proposed MCL for this element.

Studies have also delineated surface and subsurface soil contamination (see QAPjP, table 1). The groundwater contamination does not correlate with known surface and subsurface soil contamination at either HRL or the 1171 Building. Moreover, the soil moisture content is very low (averages from 2-4%); this parameter has the greatest influence on the migration of contaminants through the vadose zone to groundwater. Therefore, it is unlikely that surface and subsurface contamination pose any immediate threat to groundwater quality.

The groundwater contamination at HRL is thought to originate from Siemens Nuclear Power Company's (SNP) process waste storage lagoons. The source of the (possibly) elevated nickel concentration at the 1171 Building is unknown. Available information was utilized to generate a groundwater monitoring plan which is both specific to the data needs at each Operable Subunit and responsive to the new (lower) MCL's and proposed MCL's for nickel, cadmium, beryllium, and thallium.

As discussed in other project documents, it is imperative that groundwater data collected during continuation of the Phase II Groundwater Study at HRL be scientifically and legally defensible since a potentially responsible party (PRP) is implicated. Specifically, complete Contract Laboratory Program (CLP) type data packages will be necessary with all corresponding quality control (QC) and quality assurance [(QA, from an independent laboratory)]. Requirements of the CLP package, include field sampling logs, chain-of-custody documents, instrument calibration curves, all instrumental output (chromatogram, digital output, *etc.*) as required to perform a full, documented, data validation. The validation will be done using the methodology described in "Draft-Data Validation Procedures for Chemical Analyses," WHC, April 1992 and "Data Validation Procedures for Radiological Analysis," Procedure X.X, Revision 0, WHC, June 1991 .

At other Operable Subunits within 1100-EM-1, the need for legally defensible data is not indicated. CENPW'S strategy at these other locations is to obtain a complete data package (CLP-type, as described in the paragraph above), which will be reviewed in-house to determine if the data are consistent with previous data and that the QA and QC data are consistent. A complete data package allows formal validation of all data, or of any subset of the data, if needed for: 1) legal defensibility in light of an unanticipated PRP, 2) regulator requests, or 3) verification of data usability. The overall QA objective is to ensure that data of known and scientific quality are obtained during the study. To achieve that objective, all field activities related to sampling will be conducted in accordance with ER 1110-1-263, March 1990, and the methods described herein.

3.0 SAMPLE LOCATION AND FREQUENCY

The requirements for sampling wells within the 1100-EM-1 are location dependent. The details of the requirements for sampling and analytical requirements are presented in the

WATER SAMPLING LOG

Project/No. ______ Page ______ of ______

Site Location ______

Site/Well No. ______ Coded/Replicate No. ______ Date ______

Weather ______ Time Sampling Began ______ Time Sampling Completed ______

EVACUATION DATA

Description of Measuring Point (MP) ______

Height of MP Above/Below Land Surface ______ MP Elevation ______

Total Sounded Depth of Well Below MP ______ Water-Level Elevation ______

Held ______ Depth to Water Below MP ______ Diameter of Casing ______

Wet ______ Water Column in Well ______ Gallons Pumped/Bailed Prior to Sampling ______

Gallons per Foot ______

Gallons in Well ______ Sampling Pump Intake Setting (feet below land surface) ______

Evacuation Method ______

SAMPLING DATA/FIELD PARAMETERS

Color ______ Odor ______ Appearance ______ Temperature ______ °F/°C

Other (specific ion; OVA; HNU; etc.) ______

Specific Conductance umhos/cm ______ pH ______

Sampling Method and Material ______

Constituents Sampled	Container Description From Lab ____ or G&M ____	Preservative

Remarks ______

Sampling Personnel ______

WELL CASING VOLUMES

GAL/FT.	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

Figure 2. Water Sampling Log

9 2 1 2 7 5 0 6 7 1

5.0 SAMPLING EQUIPMENT AND PROCEDURES

The following procedures are to be used by all field personnel when conducting sampling activities within the 1100-EM-1 Operable Unit and the HRL site. Field procedures will be consistent with the methods established under OSWER Directive 9080.0-1.

All field activities will be documented in a bound field notebook using a pen with permanent black ink. Information to be recorded in the notebook includes the following:

- Date
- Weather conditions
- Names of the field team members
- Times of site arrival and departure
- Documentation of all field activities
- Equipment malfunction
- Odd or unusual occurrences
- Site visitors

The field notebook will be signed by the Field Team Leader at the end of each day of field work.

5.1 Sampling Preparation

Prior to sampling, field personnel will assemble the equipment identified in table 4. All equipment will be checked for proper operation. One closed small jar (8 oz. minimum) of tap water will be placed in each cooler so that the analytical laboratory can measure the temperature of the fluid without contaminating any samples. The mouth of the jar must be wide enough to accommodate a standard thermometer. Equipment that will come into contact with groundwater will be decontaminated before use (see paragraph 5.8 Decontamination Procedures). Field testing equipment (pH/conductivity meter, thermometer) will be tested and calibrated (see paragraph 5.2 Calibration Procedures) before each day of sampling.

Sample containers will be provided by the laboratory and will contain the appropriate preservatives. Extra sets of bottles will be included in case of breakage. Sample bottles will be counted before leaving for the field to ensure sufficient sample containers are available for the field activities scheduled for that day.

Table 4. Groundwater Sampling Equipment Checklist

SAMPLING EQUIPMENT CHECKLIST

WELL PURGING

____ Hydrostar™ pump
____ pump control box
____ discharge hose
____ generator (Honda™ 5000)
____ extension cord
____ electric water-level probe
and weighted steel tape (w/extra weights)
____ sounding line
____ calculator
____ strap or bungie cord
____ stainless steel sampling manifolds

SAMPLING

____ bailer cord
____ PVA Nitrol™ or equivalent gloves
____ Teflon™ bailers
____ Teflon™ spigot
____ Sampling caddy
____ glass or Teflon™ beakers
____ pH/conductivity meters (2)
____ extra batteries for meter
____ thermometer (3)
____ sample bottles
____ 1 jar containing H_2O per cooler
(temperature measurement)
____ sample labels
____ coolers & ice
____ portable scintillation counter
____ permanent waterproof markers
____ tape (duct, chain-of-custody, evidentiary)
____ water sampling logs
____ turbidity meter
____ carpenters chalk
____ Teflon™ tape
____ plastic sheeting
____ barracade and safety equipment
____ Acid Solutions & pH paper
____ KCl solutions

DECONTAMINATION

____ pump decon tubs
____ buckets (3 or 4)
____ distilled or deionized water
____ laboratory-grade non-phosphate
detergent
____ deionized (DI) water sprayer
____ detergent sprayer
____ scrub brushes
____ nitrile or vinyl gloves
____ trash bags
____ paper towels
____ 35 gallon garbage can

SAMPLE TRANSPORT

____ chain-of-custody records
____ lab task order
____ chain-of-custody seals
____ sealing tape
____ shipping labels

MISCELLANEOUS

____ well and gate keys
____ measuring tape
____ Ziploc ™ bags (large
and small)
____ field file box
____ first aid kit
____ toolbox
____ utility knife
____ scissors
____ screwdrivers
____ pliers
____ fishing hooks
____ field notebook
____ flashlight

Prior to leaving for the sampling location, the Field Team Leader will make arrangements for site access. Prior to sampling efforts, the field personnel will be appraised of site conditions (weather, ground surface conditions). In addition, the Field Team Leader will also arrange for appropriate handling/storage of all anticipated waste materials and waste water generated during the sampling activities scheduled.

Samples will be collected first from wells with little or no known contamination to reduce the potential for cross-contamination between wells. Upon arrival at the sampling location (wellhead), the field vehicle will be parked downwind of the wellhead. Field personnel will not smoke, drink, or eat during sampling and will avoid handling any objects not necessary for performing sampling procedures. Clean PVA Nitrol™ or equivalent gloves will be worn when handling any field equipment or samples. To prevent cross-contamination, gloves will be changed between wells, or as necessary during the sampling event.

5.2 Calibration Procedures

All field equipment requiring calibration will be calibrated daily to known standards prior to being used. Instruments and standards to be used while conducting field work during the continuation of the Phase II Groundwater Study are the following:

Instrument	Calibration Standard
pH meter	pH 4.0, 7.0, and 10.0 buffer solutions
Specific conductance meter	Dry air, 1413 μmhos/cm solution of potassium chloride
Thermometer	NIST thermometer, ice water solution
Electric water-level probe	Weighted steel tape marked in 0.01 foot increments

Users are required to follow specific calibration instructions described in the manufacturer's operating instruction manual for the pH and specific conductance meters, thermometers, and water-level probe. These instructions will be stored in the carrying cases with the devices. An entry in the field notebook will be completed each time an instrument/thermometer is calibrated. If equipment cannot be calibrated or becomes inoperable due to damage, its usage will be discontinued until the necessary repairs are made. In the interim, a calibrated replacement will be obtained and used. It is the responsibility of the Field Team Leader to ensure that all instruments are properly maintained and in working order prior to use in the field.

5.3 Groundwater Level Measurements

Monthly static water levels in all monitoring wells will be measured with an electric water-level probe. At least one water level measurement will be verified with both a weighted steel tape and an electric water-level probe. Measurement methods will be consistent with EPA's protocol for the measurement of groundwater levels.

Static water levels in all monitoring wells will be measured with an electric water-level probe prior to sampling.

Water levels in all wells will be measured on the same day if possible to obtain the most accurate representation of the water table. A minimum of two consistent measurements will be taken at each well to confirm the accuracy of the measurement. Measurements at a well will be considered consistent if they are within $\pm$ 0.02 feet of each other when using a weighted steel tape and within $\pm$ 0.04 feet of each other when using an electric water-level probe.

A pre-established and surveyed measuring point shall be utilized at the top of the well casing to establish the elevation with reference to an established datum. Depth-to-water measurements will be made from this point.

To measure water levels using an electric water-level probe, the proper operation of the electric probe will be verified prior to measurement by inserting the probe into water to ensure that contact is clearly indicated on the meter. The probe will then be lowered slowly into the well. When the electric water-level probe registers contact with the groundwater, the reading on the tape at the measuring point will be noted to the nearest 0.02 feet.

Each water-level measurement will be recorded into a field notebook following procedures described in the CEQAPP, chapter 21, together with the date and time of the measurement, the type and serial number of the measuring device, and the initials of the person taking the measurement.

The weighted steel tape or electric water-level probe will be decontaminated before the first measurement and between locations (wells) with distilled water and a clean towel.

5.4 Total Depth Measurement

The total depth of each well will be measured prior to sampling. The total depth will be measured from the measuring point at the top of the casing by lowering a weighted tape or cable until the weight is felt resting on the bottom of the well. Appropriate weights will be available and used to provide accurate definition of the total well depth.

The total depth measurements will be used to confirm that the proper well has been identified, that the well has not filled with silt, and to accurately calculate the volume of water standing in the well. The well will be redeveloped if more than 1 foot of silt has accumulated in the bottom of the well.

The sounding line will be decontaminated between locations (wells) with a laboratory-grade, non-phosphate detergent and rinsed with deionized or distilled water.

5.5 Well Purging

Well purging procedures will be consistent with those outlined in EM-1110-7-XX (FR) and OSWER Directive 9080.0-1 for groundwater sampling. The volume of water standing in the well will be calculated by subtracting the depth-to-water measurement from the total depth of the well and multiplying the result by the number of gallons per linear foot of water in the well. The gallons per linear foot is a function of the well casing diameter and is obtained from values tabulated on the Water Sampling Log. A minimum of three well volumes will be purged from each well using the dedicated submersible pump prior to sampling. All calculations will be recorded on the Water Sampling Log.

The pH, specific conductance, and temperature of the discharged water will be measured at least three times during purging (after each well volume is removed). The pH will be considered stable when two consecutive measurements agree within 0.2 standard units. Temperature will be considered stable when two consecutive measurements agree within 0.2 degrees centigrade. Specific conductance will be considered stable when two consecutive readings are within 10 percent of each other. If the pH, temperature, and specific conductance do not stabilize within the designated purging time, then purging will continue until the readings have stabilized or until three well volumes have been removed.

The purge water will be pumped into 55-gallon drums and held on-site pending analytical results to ensure proper disposition. The date, well identification, and drum identification number will be clearly marked on the outside of each drum using a permanent marking method, prior to filling. A log of each drum, the volume of purge water that it contains, and its location will be maintained in the field notebook. When appropriate, purge water may also be pumped into a purge truck arranged through DOE/RL and transferred to the 200 area for disposal.

5.6 Sample Collection

Sampling procedures will be consistent with EM-1110-7-XX(FR) and OSWER Directive 9080.0-1, for groundwater sampling. Samples will be collected using a Hydrostar™ pump, with the samples collected at the surface from a decontaminated, stainless steel sampling manifold. After the well has been purged, if a non-dedicated submersible pump was used, the pump will be removed from the well and decontaminated (see paragragh 5.8 Decontamination Procedures). A decontaminated sampling manifold will be utilized at each well for each sampling event.

If dedicated or non-dedicated pumps are not available, purging and sampling will be conducted by a Teflon™ bailer and will be accomplished in a manner that will minimize the agitation of groundwater in the well. The water will be collected in the Teflon™ bailer and discarded twice before collecting a sample. The Teflon™ bailer will be emptied with a bottom emptying spigot. Prior to reuse, the bailer will be decontaminated (see paragragh 5.8 Decontamination Procedures).

Caps on the sample containers will be left in place until just before filling. When the cap is removed from the sample container, care will be taken not to touch the lip of the bottle, the inside of the Teflon™ cap, or the mouth of the spigot.

The sample bottle will be filled slowly by placing the mouth of the spigot against the inner side of the sample bottle to prevent trapping any air bubbles. Care will be taken to avoid splashing or agitating the water while the bottle is being filled.

For bottles requiring zero headspace (*i.e.*, volatile organic analyses), the bottle will be filled completely so that a meniscus forms over the mouth. The bottle will be capped immediately, turned upside-down, and tapped a few times to check for air bubbles in the sample. If a bubble exists, the sample will be discarded and the sampling procedure will be repeated until a bubble-free sample is obtained.

For samples collected for analyses of dissolved constituents, the sample will be decanted from the Teflon™ bailer into a clean Teflon™ or glass beaker.

After each sample bottle is filled and capped, a sample label which identifies the sample number, date and time of sampling, matrix, type of preservative, and initials of sampling personnel will be affixed to the sample container. An example of a sample label is provided in figure 3. Samples will be placed in a cooler with wet ice (in Ziplock™ bags) or frozen reusable ice packs for storage and transport to the laboratory.

Field parameters (pH, temperature, and specific conductance) will be measured by filling a Teflon™ or glass beaker with a groundwater sample and placing the probes and a thermometer in the beaker. Measurements will be recorded on the Water Sampling Log. The color, odor, appearance, and other observations about the sample will also be recorded on the Water Sampling Log.

Field screening during groundwater sampling for radioactivity, will be performed. All samples with levels of radioactivity exceeding 200 counts/minute (or "background") as detected by a portable Beta-Gamma scintillation counter such as an Eberline™ model HP-210 or equivalent, will be routed to a Hanford Site participant laboratory that is equipped and qualified to analyze radioactive samples. Samples exhibiting levels of radioactivity exceeding background will not be released to an offsite laboratory based on field measurements. They

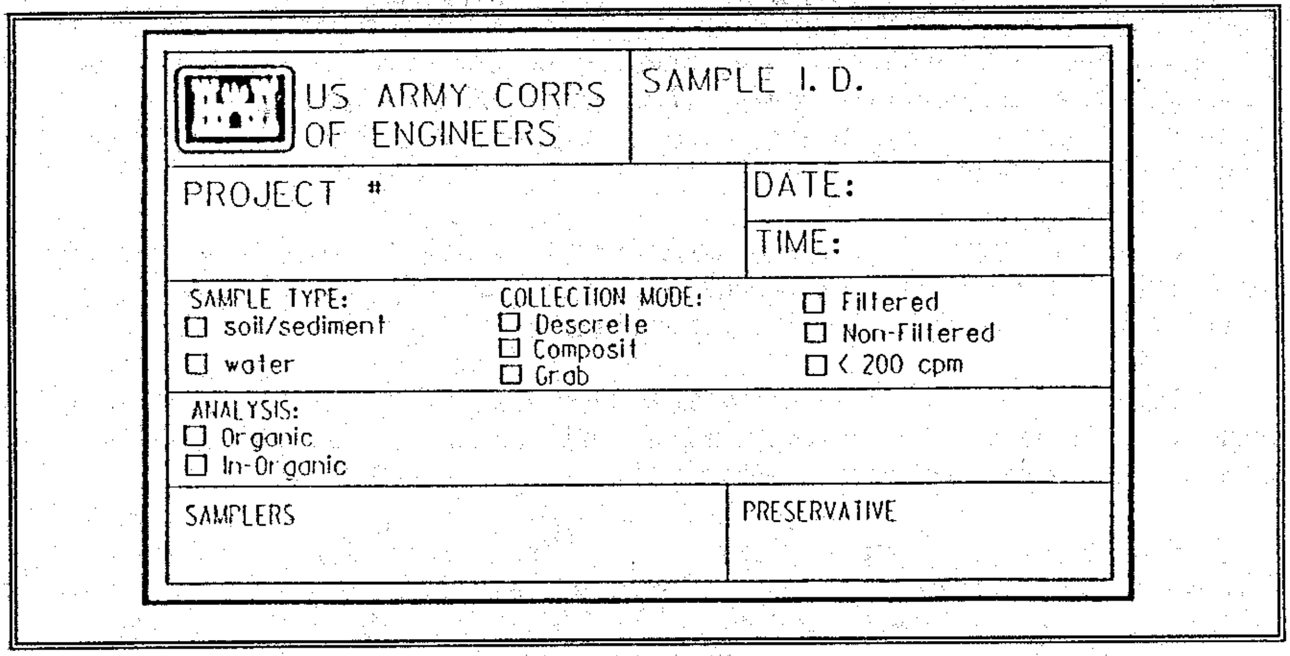

Figure 3. Sample Label

may only be released in accordance with CENPW procedures and in compliance with the DOE-RL shipping regulations as defined below. It is anticipated that no groundwater samples from 1100-EM-1 will exceed background. To date, following 8 sampling events, no samples have exceeded backround levels.

The current DOE-RL limits for shipment of radiological materials are as follows:

Shipped material must have activity levels less than those stated below:

- 1.0 mR/hour at surface contact of sample
- 100 nCi/gram total activity (ß and γ)
- 10 nCi/gram total activity

No transuranium waste will be shipped offsite. The current definition from the QAPjP of transuranium waste is "without regards to form, waste > 100 nCi/gram alpha-emitting transuranium radionuclides with half-lives greater than 20 years."

5.7 Quality Control Samples

Quality control samples will be collected at the frequency of 10 % as specified in paragraph 3.1.1 of the QAPjP. The procedures for obtaining the required QC samples including field blanks, trip blanks, equipment rinsates, field duplicates, reference samples, material blanks, and split samples are specified in paragraphs 3.0 and 9.0 of the QAPjP and as required under chapter 21, paragraphs 21.6.6.3 and 21.6.6.4 of the CEQAPP.

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5.8 Decontamination Procedures

Reusable sampling equipment, including the equipment used to measure field parameters, will be decontaminated prior to use and after each sampling event to avoid chemical cross-contamination of field samples. Equipment will be decontaminated by washing with a laboratory-grade, non-phosphate detergent and rinsing with distilled or deionized water. Wash and rinse water will be disposed of in the same manner as specified for purged well water (see paragraph 5.5 Well Purging). All field personnel will wear clean nitrile or vinyl gloves when conducting decontamination procedures.

6.0 SAMPLE HANDLING AND ANALYSIS

6.1 Sample Preservation and Storage

The types of bottles and preservatives required for each type of groundwater analysis are identified in tables 2 and 3. All water samples will be stored in a cooler with wet ice or frozen reusable ice packs immediately after collection. The ice will be distributed evenly so that all samples are in physical contact with the ice.

The cooler of filled sample containers will be transported to the laboratory for analysis. Based on results of eight previous rounds of groundwater data, it is anticipated that the cooler(s) of filled sample containers will be transported directly to the laboratory for analysis.

6.2 Chain-of-Custody Procedures

Sample custody is a vital aspect of groundwater monitoring studies because the data generated may be used as evidence in a court of law. The samples must be traceable from time of sample collection until the time the data are introduced as evidence in legal proceedings. Most critical is the ability to substantiate that the samples were not tampered with before laboratory analyses were conducted[1].

All samples will remain in the custody of the sampling personnel during each sampling day. At the end of each sampling day and prior to the transfer of the samples, chain-of-custody entries will be made for all samples using a chain-of-custody record (figure 4). One chain-of-custody record will be completed for each cooler of samples. All information on the chain-of-custody record and the sample container labels will be checked against the sampling log entries, and samples will be recounted before transferring custody. Upon transfer of custody, the chain-of-custody record will be signed by a member of the

[1] Jeffrey C. Worthington (Director of Quality Assurance), Kerri G. Luka (Audit Programs Manager), R. Park Haney Esq. (Vice President), TechLaw, Inc. 12600 W. Colfax Avenue, Suite C-310, Lakewood, Colorado 80215: *Factors Affecting the Admissibility and Weight of Environmental Data as Evidence*, Presented at the Seventh Annual Waste Testing and Quality Assurance Symposium, July 8-11, 1991, Washington, D.C.

CHAIN-OF-CUSTODY RECORD

PROJECT

SAMPLERS: (Signature)

SAMPLE NUMBER	DATE	TIME	COMP	GRAB	NO. CONTAINERS											REMARKS OR SAMPLE LOCATION	PRESERVATION: ICED	PRESERVATION: SPECIFY CHEMICAL ADDED AND FINAL pH IF KNOWN

Relinquished by: (Signature) 1	Date/Time	Received by: (Signature)	Relinquished by: (Signature) 4	Date/Time	Shipped via:
Relinquished by: (Signature) 2	Date/Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date/Time	Shipping Ticket No.
Relinquished by: (Signature) 3	Date/Time	Received by: (Signature)	Remarks		

Figure 4. U.S. Army Corps of Engineers Chain-of-Custody Record.

field team, sealed in plastic, and taped to the inside lid of the cooler. A signed, dated chain-of-custody seal (figure 5) will be placed over the lid opening of the sample cooler to indicate if the cooler is opened during shipment.

An official sample seal (evidentiary seal, figure 6) will be used for samples where the related analytical results may have the potential to be introduced as evidence into a court of law. When required, the official sample seal will be taped over the outside of the lid and connected to each side of the sample container, thus sealing the sample container before placing the sample into a cooler. The official sample seal will exhibit the sample number, date sealed, signature and printed name of the sampler. Laboratory personnel, prior to breaking the official sample seal to allow analytical work on the sample, will be required to date and sign the official seal, insuring there has been no tampering of the sample during shipment. According to EPA's National Enforcement Investigations Center (NEIC), a sample is in a person's *custody* if:

- The sample is in the person's actual possession, or
- The sample is in a person's view, after being in their actual physical possession, or
- The sample was in their actual physical possession and then they locked it up to prevent tampering, or
- The sample is in a designated and identified area of security.

CUSTODY SEAL

Person Collecting Sample ______________________ (signature) Sample No. ____________

Date Collected ______________________ Time Collected ____________

Figure 5. Chain-of-Custody Seal.

U.S. ARMY CORPS OF ENGINEERS
Official Sample Seal

SAMPLE NO.	DATE	SEAL BROKEN BY	DATE
SIGNATURE			
PRINT NAME AND TITLE			

Figure 6. Official Sample Seal.

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All chain-of-custody records received by the laboratory must be signed and dated by the laboratory's sample custodian. The custodian at the laboratory will note the condition of each sample received as well as questions or observations concerning sample integrity. The sample custodian will also maintain a sample-tracking record that will follow each sample through all stages of laboratory processing. The sample tracking records must show the sample number, the date the sample was taken, the date the sample was received by the laboratory, the date of sample extraction, source of the sample, sample analysis and methodology used. The sampling tracking records will be used to determine compliance with holding time limits during laboratory audits and data verification and validation.

6.3 Groundwater Samples

The analytical procedures to be conducted on groundwater samples are specified in tables 2 and 3. Temperature, pH, and specific conductance will be measured in the field according to instrument manufacturers' instructions and relevant specified EPA methodology. Laboratory protocol, quality control procedures, and data reporting requirements are discussed in the QAPjP.

6.4 Shipment and Storage of Data Originals

All samples will be reviewed and verified by the Laboratory Quality Assurance Manager. An exception to this review and verification is for those samples analyzed via special analytical services, or, analytical results from a CENPW Contractor and the independent QA (Corps of Engineers, Missouri River Division (CEMRD) laboratory, or its representative). Appropriate data qualifier codes will be applied to those data for which QC parameters do not meet acceptable standards. As soon as the respective data packages are complete, CENPW Contractor Laboratory and CEMRD-Laboratory will duplicate their respective data results packages and mail the originals by registered mail to the Laboratory Manager at CENPW. Upon receipt, these data packages will be logged, duplicated, and the originals immediately secured from fire, tampering, or theft by filing in a fireproof cabinet within a concrete vault at CENPW[2]. This vault is attended by a CENPW employee during the day and securely locked when the attendant leaves.

6.5 Preparation of the Chemical Quality Assurance Report (CQAR)

A duplicate of the analytical data package will be sent (by CENPW Contractor's Laboratory) to the designated Corps of Engineers QA Laboratory (CEMRD-Laboratory). The QA laboratory will prepare the CQAR within 30 days of receipt of the contractors analytical data.

This report will include an overall evaluation of the Contractor's and Government lab results, problems in accomplishing the Chemical Data Acquisition Plan, and lessons learned

[2] Unless otherwise instructed by the Department of Energy-Richland Field Office.

as described in ER-1110-1-263, appendix E. Data quality acceptance criteria are specified in the EPA Laboratory Data Functional Guidelines (EPA 1988a and 1988b).

6.6 Data Validation

All data originating from the analysis of groundwater samples from HRL will undergo full CLP-type data validation. In this case full validation will replace the CQAR and will be accomplished by either the CEMRD or CENPW Contractor following the methodology described in "Draft-Data Validation Procedures for Chemical Analyses," WHC, April, 1992 and "Data Validation Procedures for Radiological Analysis," Procedure X.X, Revision 0, WHC, June 1991. The documentation for the data validation may be used as evidentiary data, thus all originals must be shipped, logged, and stored as described in paragraph 6.4.

7.0 REFERENCES

EPA, September 1986, *Protocol for Groundwater Evaluations*, OSWER Directive 9080.0-1, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988a, *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses*, U.S. Environmental Protection Agency, Washingtion, D.C.

EPA, 1988b, *Laboratory Data Validation Function Guidelines for Evaluating Inorganic Analyses*, U.S. Environmental Protection Agency, Washingtion, D.C.

EPA, 1988c, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, OSWER Directive 9355.3-01, U.S. Environmental Protection Agency, Washington, D.C.

SNP, 1991, *Work Plan, Phase I Groundwater Study,* Preliminary Schedule for Phase I Study, Siemens Nuclear Power Corporation, Richland, Washington.

USACE, October 1990, *Chemical Data Quality Management for Hazardous Waste Remedial Activities*, ER 1110-1-263, U.S. Army Corps of Engineers.

USACE, September 1991, *Monitor Well Installation at Hazardous and Toxic Waste Sites*, EM-1110-7-XX(FR), U.S. Army Corps of Engineers.

WHC, April 1992, *Draft-Data Validation Procedures for Chemical Analyses*, Westinghouse Hanford Company, Richland, Washington.

WHC, June 1991, *Data Validation Procedures for Radiological Analysis*, Procedure X.X, Revision 0, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX D

SITE SAFETY AND HEALTH PLAN

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1.0 PROJECT NAME

Groundwater Sampling Activity at the 1100-EM-1 Operable Unit and Horn Rapids Landfill

Job Description: Sample and analyze groundwater at Horn Rapids Landfill and other sites in 1100-EM-1

Requested by: W.L. Greenwald (U.S. Army Corps of Engineers) - Technical Manager

Proposed Start Date: January 1992

2.0 PROJECT DESCRIPTION

Horn Rapids Landfill (HRL) is an inactive landfill that was operated as a solid waste disposal facility from 1950 to 1970 and accepted a variety of miscellaneous industrial waste and construction debris. The effort covered under this Site Safety and Health Plan (SSHP) is intended to further characterize the HRL in order to identify a cost-effective remediation method for this site. This effort is controlled under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Tri-Party Agreement. Invasive characterization activities have been completed including: soil gas sampling, surface geophysics techniques, and excavation. Information gained from these methods was used to direct the next phase of characterization, which involved excavation of eight trenches in predetermined locations to accurately characterize the waste and sedimentary makeup of the landfill. This phase of the project includes sampling and analysis of groundwater taken from existing groundwater monitoring wells located at HRL and other sites in 1100-EM-1.

Per the requirements established in ER 385-1-92, *Safety and Occupational Health Document Requirements for Hazardous Waste Site Removal Action*, this plan addresses potential site specific hazards and the recommended and required methods for minimizing physical and chemical risk to personnel involved in the sampling activities. The hazards addressed in this plan, although based on the most current information and data collected at the HRL, should not be considered exhaustive. Landfill excavations characteristically have numerous unforeseen chemical and physical hazards, especially in instances such as HRL, where little, if any, operating records were generated. Therefore, it is not always possible to predict all of the hazards in a prejob plan.

This SSHP is supported by the Remedial Investigation (RI)/Feasibility Study Work Plan for the 1100-EM-1 Operable Unit, and together they provide procedures for conducting a safe project.

3.0 LOCATION

The HRL is located on the Hanford site approximately 1,000 feet northeast of the Siemens Nuclear Power Corp. (formerly Advanced Nuclear Fuels Corp.) along the Horn Rapids road. It is on the southern boundary of the Hanford Reservation and immediately adjacent to the city of Richland property. The facility is bordered to the south by a wire fence which runs parallel to the Horn Rapids road. A gate with a padlock and chain limits access to the land-fill area. The landfill is contained within the CERCLA 1100-EM-1 Operable Unit boundaries. Figure 1 shows a map of the HRL and vicinity.

4.0 FACILITY/WORK SITE DESCRIPTION

The HRL was operated for approximately 20 years as an industrial landfill for nonradioactive waste. The landfill covers an area of approximately 50 acres and is made up of at least five known disposal trenches. These elongated trenches are arranged in a generally southeast to northwest direction. As is typical of most landfills, disposal activities were poorly documented. Various materials are known to have been dumped at this location including: construction and demolition debris, tires, waste liquids, asbestos, chemical reagents, and fly ash from the 1100 and 300 areas. Surficial waste consisting of paint cans, steel cables, sheet metal, concrete rubble, and sewage sludge are sparsely scattered over the landfill . Additionally, anecdotal information (*i.e.*, information gathered from former Hanford employees) indicates that there could be as many as 200 drums of carbon tetrachloride and small amounts of explosive compounds (picric acid and ethers) disposed of in the landfill.

Based upon process operations occurring in the vicinity of the landfill, small quantities of the following wastes <u>may</u> have been disposed of in the HRL:

- Antifreeze
- Battery acid
- Degreasers
- Hydraulic oils
- Lacquer thinners
- Paint (latex, oil-based, others)
- Penetrating oils
- Solvents
- Waste oil
- Undercoating material
- Automotive cleaners
- Contact cement
- Gasoline
- Industrial lubricants
- Metal cleaners
- Paint thinners and removers
- Reagent chemicals
- Roof patching sealant
- Stains
- Vinyl adhesives

Surface geophysical surveys (Electro-Magnetic Induction, magnetometer, and ground-penetrating radar) were performed at the site to determine locations for the excavations. Surface geophysical surveys produced no definitive evidence of shapes or objects beneath the surface that would indicate the presence of 55 gallon drums. However, based on a few

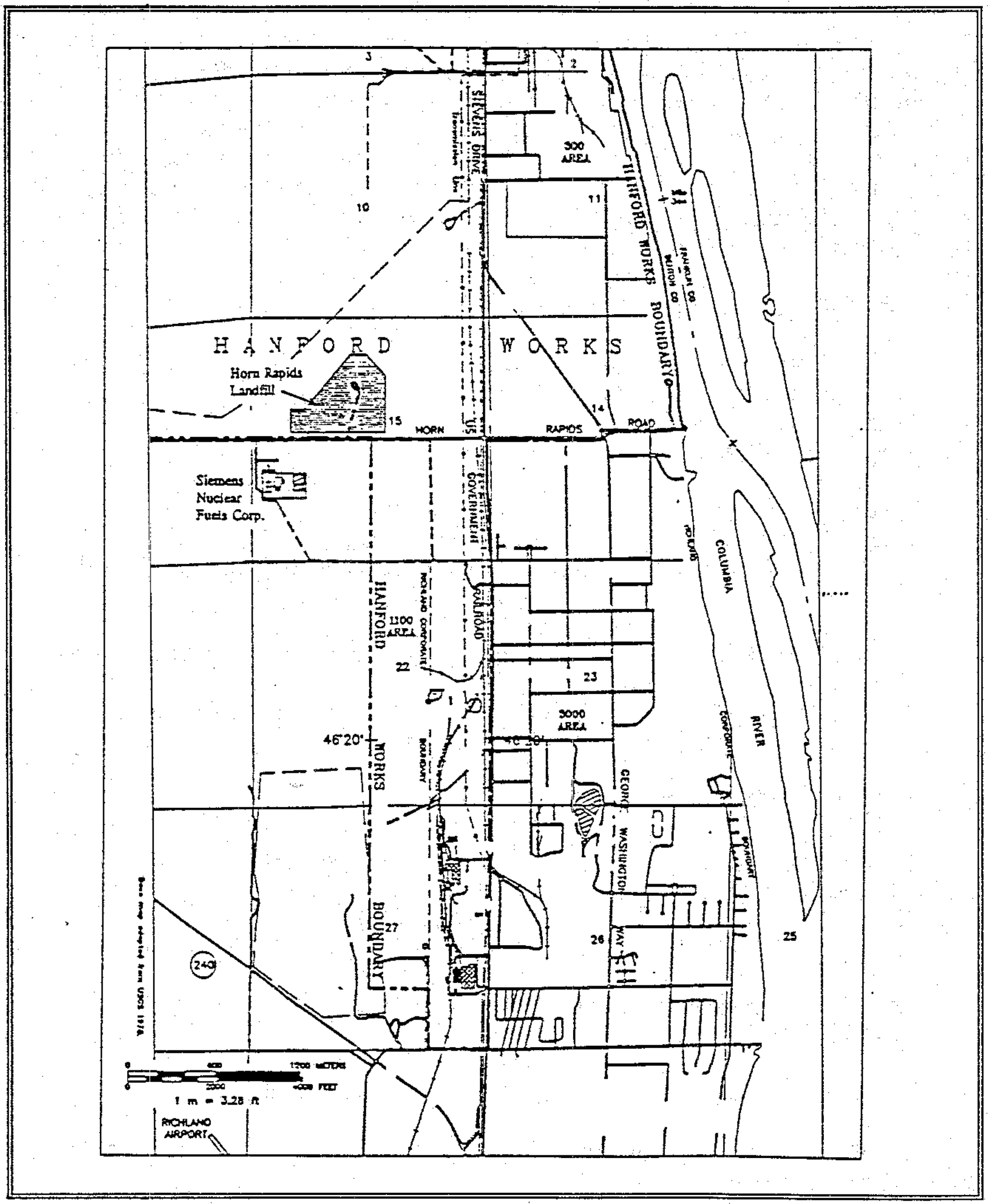

Figure 1. Map Showing the Horn Rapids Landfill and Vicinity

anomalies, a decision was made to begin exploratory trenching. These locations were then prioritized based on results from numerous soil gas surveys performed by Golder and Associates, Inc. Soil gas surveys detected measurable concentrations of trichloroethene; tetrachloroethane; and 1,1,1-trichloroethane. Carbon tetrachloride was detected in only one sample location and the concentration was very low. Golder and Associates, Inc., documented that the observed levels of organics were not sufficient enough to suspect free product below the landfill surface. Trenching activities uncovered no barrels of carbon tetrachloride or any other large volume of solvent waste.

5.0 PROPOSED PERSONNEL AND JOB FUNCTIONS

Technical Manager: **W. L. Greenwald**
Field Team Leader: **Richard Fink**
Geologist: **Tina Bushnell**
Chemist: **Lee Chassy**

Proposed Field Team	Job Function
Chemist/Sampler (1)	Provide quality assurance (QA)/quality control (QC) support, interpret analytical results, and perform sampling activities.
Geologist/Sampler (1)	Perform characterization and sampling activities.
Field Team Leader (FTL)/ Site Safety Officer(SSO) (1)	Coordinate characterization activities, safety oversight, and air monitoring.

6.0 OTHER POTENTIAL HAZARDS

[X]	Chemical (organic)	[ ]	Cutting and Welding
[ ]	Radiological	[ ]	Trenching and Shoring
[X]	Fire and Explosion	[ ]	Fugitive Dust
[X]	Heat Stress and Cold Stress	[X]	Heavy Equipment and Vehicular Traffic*
[ ]	Electrical		
[X]	Machinery and Mechanical equipment	[ ]	Overhead Hazard
		[ ]	Noise
[X]	Trips, Slips, Falls	[X]	Dangerous Wildlife and Insects
[ ]	Confined Space	[ ]	Other - described below

* NOTE: Traffic will not be near wellheads but will be concentrated around zones where workers will likely congregate.

Other potential hazards at the site are covered in the following paragraphs. Evaluation of overall hazards indicates a low potential.

The mitigation of potential hazards identified in this section are within the scope of the SSHP and are addressed below.

6.1 Chemical

See paragraph 7 for specific chemical hazards and controls.

6.2 Radiological

The site is, for the most part, free of radiation; however, some elevated gross beta/alpha radiation has been detected in several groundwater samples. No soil samples have been noted with levels above background. A Health Physics Technician (HPT) will verify that groundwater samples do not exceed background levels of radioactivity prior to shipment to contractor laboratory.

6.3 Fire and Explosion

Although fire and explosion hazards encountered during sampling activities are expected to be minimal, workers should be aware that flammable gases and volatile organic liquids may be encountered. To minimize fire and explosion potential, the following precautions should be adhered to:

a. A fire extinguisher and shovels will be carried in each vehicle.

b. No smoking or open flames will be allowed within the waste site.

6.4 Heat Stress and Cold Stress

Since sampling activities will be taking place outside during the winter months, heat stress will not be a problem. Cold stress could be a problem since cold temperatures, wind, and/or wet weather is possible.

Cold stress will be dealt with by wearing insulated inner and outer clothing and watching the temperature and wind chill closely. Workers will wear rain jackets or other means of protective clothing to keep them dry during periods of wetness. If cold stress becomes a concern, work/rest regimes will be arranged. The American Confederation of Government Industrial Hygienist, Threshold Limit Value Booklet (1990-1991 edition) shall be used for assessing cold stress.

Heat stress is a major concern and symptoms must be monitored by the FTL if the ambient temperature exceeds 70° F onsite during work activities as it will during the May and September rounds of groundwater sampling. Although there is no need for workers to wear chemical suits or other restrictive clothing, heat stress is still a potential problem. In chapter

8 of the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* there is a checklist that shall be used for all workers, especially those using personal protective equipment (PPE).

6.5 Electrical

All temporary wiring shall conform to the National Electric Code. All outdoor receptacles shall be ground fault interrupter protected.

6.6 Machinery and Mechanical Equipment

No heavy machinery will be required in this phase of the RI work. Some mechanical equipment such as pumps, *etc.*, will be used. All equipment is small and of minimal concern.

6.7 Trips, Slips, Falls, and Unstable or Uneven Terrain

The ground in the HRL area is uneven with numerous holes, tripping hazards, and uneven walking/working surfaces. In addition, surface debris is known to exist at the landfill. Care should be taken to avoid stepping on sharp or piercing objects on the ground surface.

NOTE: Terrain around test wells is generally flat and free of debris. During the winter months, care should be taken due to icy or wet conditions, ponding water, *etc.*

Good housekeeping practices must be followed to reduce clutter at the HRL site. This will reduce the risks of trips, slips,and falls. Plan routes in and around the site to avoid tripping hazards.

NOTE: The chance of personnel injury due to tripping, slipping, and falls is compounded when respiratory protection is worn. Personnel must be aware of this and take care to think ahead and plan movements to allow for reduced visibility and mobility.

6.8 Cutting and Welding Procedures

Cutting and welding is not anticipated for this task; however, if performed, the precautions checked below, as well as the precautions discussed in paragraph 6.3, will be followed.

- Combustibles will be relocated or protected.
- Combustible floor will be wetted down or covered.
- Flammable gas concentrations (% Lower Explosive Limit) in air will be checked.
- Wall, floor, duct, and tank openings will be covered.
- A fire extinguisher will be provided.

6.9 Trenching and Shoring

No trenching or shoring will be required.

6.10 Fugitive Dust Control

Due to occasional high winds and the arid climate, the Hanford site always has a potential for dust problems. No soil disturbance will take place during the sampling activity. Refer to Environmental Protection Agency (EPA) publication EPA/540/285/003 "Dust Control at Hazardous Waste Sites."

6.11 Vehicular Traffic

Private vehicles are restricted from the site and will never be used in the transport of samples. No control zone will be depicted for work limited strictly to sampling activity at this site. Workers not involved in direct sampling activities will congregate near the vehicles. Drivers must be aware of personnel positions before moving vehicles on, off, or around the site.

6.12 Overhead Hazard

Sample activity should not require the use of equipment that would present an overhead hazard.

6.13 Noise

Noise levels exceeding 85 dBA are not anticipated for groundwater monitoring activities. If noise levels do exceed 85 dBA, the area will be posted as a noise hazard area and workers will wear hearing protection.

6.14 Dangerous Wildlife and Insects

Workers should be aware that rattlesnakes and scorpions are indigenous to the area. High-top boots are recommended but not required. All safety shoes will meet American National Standards Institute Z41-1983.

7.0 CHEMICAL AND RADIOLOGICAL POTENTIAL EXPOSURE HAZARD DURING GROUNDWATER MONITORING ACTIVITIES

Waste Media:
[X] Airborne contamination
[X] Surface contamination
[X] Contaminated soil
[X] Contaminated groundwater
[ ] Contaminated surface water
[X] Solid waste
[X] Liquid waste

Hazardous Characteristics:
[X] Ignitible
[X] Corrosive
[X] Reactive
[X] Explosive
[X] Toxic (nonradiological)
[X] Radioactive
[X] Sludge (sewage)

This task will involve the reasonable possibility of exposure to the substances listed below at concentrations or in quantities that may be hazardous to the health of site personnel. Radiological concerns are addressed in paragraphs 13 through 17.

NOTE: Due to moderate vapor pressures and evaporation rates and the expected concentrations of the concerned organic solvents, it is anticipated that inhalation hazard will be minimal. Previous particulate and soil gas readings also indicate low concentrations of contaminants. Ingestion of compounds via inhalation of particulate is minimal based on previous airborne particulate sampling.

Surface level concentrations of the organic solvents listed is negligible.

Air sampling of particulate onsite has been conducted. The presence of chromium, lead, mercury, nickel, niobrium, potassium, rhodium, ruthenium, silicon, strontium, sulfur, titanium, and zirconium has been found in samples. Titanium is the most significant landfill contaminant in the particulate fraction. Titanium is inert and concentrations are far below the established Personal Exposure Level. Airborne asbestos fiber samples taken before and during trenching operations were < .005f/cc. Silicon levels were measured at 9,000 ng/m^3, which is .009 mg/m^3. The current Occupational Safety and Health Administration (OSHA) standard for respirable silica is .1 mg/m^3. It is not known if these samples were taken during windy or calm conditions.

Primary Hazard (Rate: neg, low, mod, high, ext)

	Inhalation of:			Dermal Absorption of:				
Substance	Gases/ Vapors	Dust/ Mist	Ingestion	Solids/ Liquids and/or Skin Contam.	Gases/ Vapors	Corrosive/ Irritant	Ignit- ability	Reactivity/ Explosion
Trichloroethene	Mod	Low	Mod	Low	Mod	Mod	High	High
Tetrachloroethane	Mod	Low	Mod	Low	Mod	Mod	Low	Low
1,1,1-Trichloroethane	Mod	Low	Mod	Low	Mod	Mod	Neg	Neg
Carbon Tetrachloride	Mod	Mod	High	Mod	Low	Low	Low	Low
PCB	Mod	Low	Mod	Low	Mod	Low	Low	Mod
Chromium	Mod	Mod	Mod	Mod	Low	Low	Mod	High
Arsenic	Mod	Mod	Mod	Mod	Mod	Low	Low	Low
Nickel	Low	Mod	Mod	Mod	Low	Low	Low	Low
Nitrates	Low	Low	Low	Low	Low	Mod	Low	Low
Methane	Mod	Low	Low	Low	Low	Low	High	High

Sources

Substance	Exposure Limit	IDLH Level	Health Effects
Trichloroethene	50 ppm/270 mg/m^3	1000 ppm	Moderately toxic by ingestion and inhalation. Eye and skin irritant. Prolonged inhalation causes headaches and drowsiness. Acute inhalation exposure may be fatal.
Tetrachloroethane	1 ppm/7 mg/m^3	150 ppm	Poisonous by ingestion and inhalation. Mildly toxic by skin contact.
1,1,1-Trichloroethane	350 ppm/1910 mg/m^3	1000 ppm	Moderately toxic by ingestion, inhalation, or skin contact. Skin irritant. May cause cardiac arrest if inhaled in large doses.
Carbon Tetrachloride	2 ppm/12 mg/m^3	300 ppm	Poisonous by ingestion and possibly through other routes. Mildly toxic by inhalation. An eye and skin irritant. Damages liver, kidney, and lungs. A suspected human carcinogen. The odor threshold for this compound is 70 ppm.
PCB	NA /0.001 mg/m^3	10 mg/m^3	Moderately toxic by ingestion. Suspected human carcinogen. Effects skin and toxic to liver.
Chromium	NA /0.5 mg/m^3	NA	Human poison by ingestion with gastrointestinal effects. Suspected carcinogen.
Arsenic	NA /0.002 mg/m^3	100 mg/m^3	A human carcinogen. Human systemic, skin and gastrointestinal effects by ingestion.
Nickel	NA /0.015 mg/m^3	NA	Poisonous by ingestion.
Nitrate	NA	NA	Health effects from nitrates depends largely on the chemical form of the radical.
Methane	NA	NA	Possible asphyxiant and also highly flammable.

NOTE: A Material Safety Data Sheet (MSDS) for each of the above chemicals will be at the HRL site.

NOTE: Other intermediate chemical products may also be present. The biological and chemical degradation or dechlorination of trichloroethane, for example, produces cis- or trans 1,2-dichloroethene or 1,1-dichloroethane and is eventually broken down to vinyl chloride.

8.0 BIOLOGICAL MONITORING AND MEDICAL SURVEILLANCE

All personnel conducting sampling will be part of a routine medical surveillance program for hazardous waste workers. No other biological monitoring is necessary unless site conditions change.

9.0 ONSITE CONTROL

Sampling activities normally will not require the establishment of a control zone or exclusion zone. Orange cones may, however, be placed around the vicinity of the wellhead to keep vehicles from approaching too closely. If, for some reason, a containment zone is required, this decision will be jointly decided upon by the FTL and the SSO. Purge water removed from the wells will be placed in 150-gallon purge troughs and held until a determination has been made to release it.

10.0 PERSONAL PROTECTIVE EQUIPMENT

The initial level of protection for sampling monitoring wells will be Level D protection, with the exception of hand protection. Hand protection will be selected based on the type of contaminant suspected in the sample. The following gloves have been selected as best suited, based on glove permeation and degradation rates for the following chemicals likely to be found at HRL.

Contaminant	Glove Material
Trichloroethene (suspected carcinogen)	Poly Vinyl Alcohol (PVA) or Nitrile
Tetrachloroethane (suspected carcinogen)	PVA
1.1.1 Trichloroethane	PVA
Carbon tetrachloride (suspected carcinogen)	PVA or Nitrile

NOTE: Surgical gloves are made of latex and are not adequate protection against organic solvents, however, surgical gloves may be used if the suspected contaminant is not one of those listed above.

Samplers shall stay upwind of wellheads and purge water as much as possible. Eye protection shall be worn while sampling. The level of personal protection will be increased if monitoring dictates an increase in protection.

If in-process monitoring for organic vapors requires an upgrade in PPE and the use of air purifying respirators is authorized, government modification authorization (organic vapor) is the appropriate type of canister or cartridge for use with the specified substances and concentrations anticipated. All respirator protection will meet EM 385-1-1 and NPWOM 385-1-1 standards. Health physics advice will be requested for proper respiratory protection should radiological contaminants be detected. If radiation contamination is detected, PPE will be upgraded and a radiation work permit will be emplaced.

Poly vinyl alcohol gloves are the glove of choice to protect personnel from organic compounds. These gloves are required for samplers where direct contact with liquid is possible. Other personnel will wear appropriate gloves as determined by the SSO.

The following is a list of the specific protective equipment and material (where applicable) for each of the levels of protection:

<u>Level B</u>

[X] Pressure demand airline
[ ] Pressure demand airline with escape provisions
[ ] Pressure demand self-contained breathing apparatus (SCBA)
[X] Full body Saranex coveralls (outer)
[X] Steel-toed boots
[X] Hard hat
[X] PVA gloves (see note below)
[X] Hanford issue blue coveralls (inner)

<u>Level C</u>

[ ] Half-face air-purifying respirator
[X] Full-face air-purifying respirator
[ ] Full-face canister air-purifying respirator
[X] Steel-toed boots
[X] Hard hat
[X] PVA gloves (see note below)
[X] Hanford issue blue coveralls (inner)
[X] Full body Saranex coveralls (unless otherwise specified)

<u>Level D</u>

[X] Steel-toed boots
[X] Hard hat
[X] Leather gloves (see note below)
[X] Safety glasses or face shield as specified by SSO

NOTE: NO CHANGES TO THE SPECIFIED LEVELS OF PROTECTION SHALL BE MADE WITHOUT THE KNOWLEDGE AND APPROVAL OF THE HEALTH AND SAFETY OFFICER. (CENPW-SO) Dick Coonfare, (509) 522-6798.

The following hand signals will be used at the site:

Signal	Meaning
• Hand gripping throat	• Out of air, cannot breathe
• Grip partners wrist or both hands around waist	• Leave area immediately
• Hands of top of head	• Need assistance
• Thumbs up	• OK, affirmative
• Thumbs down	• No, negative

Personnel may use other means to communicate, *i.e.*, paper, markers, chalkboard, *etc.*

11.0 DECONTAMINATION

No formal decontamination is required for this activity. If conditions change which will require Level C or better protection, the following procedure will be followed:

11.1 Personal Decontamination

The specific requirements for decontamination are spelled out in appendix D of the *Occupational Safety and Health Guidance Manual for Hazardous Waste Activities*, October 1985.

11.2 Emergency Decontamination Procedures

Serious personal injury takes precedence over decontamination procedures. Do not attempt personal decontamination if the injury will be aggravated. An injured person should first be removed from immediate danger. Then, if determined necessary by the SSO and HPT, decontamination can take place prior to leaving the site for medical treatment.

If the extent of the personal injury is unknown, emergency medical response personnel (fire department) will make the decision to move the injured. The HPT may have to escort the injured to the hospital. If the injured is not decontaminated prior to transport to the hospital, all personnel coming in contact with the person (hospital personnel, emergency medical technicians, *etc.*) shall be informed as to the nature and risk of the contamination.

12.0 RADIOLOGICAL CONDITIONS

Landfill documentation does not identify any radioactive material disposal. Therefore, an HPT will not be required to monitor these activities.

Contamination Potentials (Rate-neg, low, med, high, ext):

- neg Alpha
- neg Beta/Gamma
- neg Beta
- neg Gamma
- neg Neutron

Exposure Rates Expected Average/Maximum: background/< 2 times background

Smearability/Fixed: < 2000 dpm/100 cm^3

Whole Body/Extremity: < 0.5 mrem/hr

13.0 HEALTH PHYSICS TECHNICIAN COVERAGE

[X] None [ ] Intermittent [ ] Continuous [ ] See Radiation Work Plan

HPT coverage required when: N/A

HPT coverage required until: N/A

Authorized HPT's: HPT pool

14.0 PERSONAL PROTECTIVE EQUIPMENT FOR RADIOLOGICAL HAZARDS

No radiological hazards are known to exist; therefore, Level D PPE is adequate.

15.0 RADIATION DOSIMETRY EXTERNAL

[ ] Basic TLD
[ ] Pencil
[ ] PADI
[ ] Other
[X] HMPD
[ ] Finger ring
[ ] Timekeeping

Known Or Suspected Isotopes: Uranium, Thorium, Radium

16.0 ONSITE ORGANIZATION AND COORDINATION

To be completed onsite.

Technical Manager: **W. L. Greenwald**
Field Team Leader: **Richard Fink**
Site Safety Officer: **Mike Remington**
Designated Health Physics Technician: **N/A**
Alternate Health Physics Technician: **N/A**

Work Team

Name	**Job Function**

17.0 TRAINING AND SPECIAL REQUIREMENTS

All field personnel are required to have taken an approved 40-hour hazardous waste course as required by 29 Code of Federal Regulation 1910.120(e). In addition, one member of the team must have a current first aid/CPR certification. Samplers must also have taken the Westinghouse Hazard Communication/Purge Water Course #02006W, or equivalent. Training records must be available onsite. Any team member having a work resolution or who has any other physical condition affecting his/her ability to work safely must report this to their manager who, in turn, must notify the FTL prior to beginning site work.

18.0 SANITATION REQUIREMENTS

Potable water supply and soap available on work site?
[X] Yes
[ ] No

Portable toilets required on work site?
[ ] Yes; if yes, how many ___
[X] No

Temporary washing/shower facilities required at work site?
[ ] Yes; if yes, describe below.
[X] No; if no, state location of existing facilities.

Nearest available shower is located at 1100 area bus lot. At a minimum, a pressurized portable eye wash/drench hose with a 15-minute water supply will be available onsite at all times.

19.0 EMERGENCY PROCEDURES

Yes No
[X] [ ] Onsite communications required? Emergency channel: Station 1

Nearest telephone: Cellular phone onsite; call 373-3800 for emergencies.

19.1 Fire or Explosion.

In the event of a fire or explosion, take immediate action if the situation can be readily controlled with available resources without jeopardizing the safety and health of site personnel or the public. The signal to evacuate the controlled areas will be two blasts of the portable air horn or a car horn. Verbal directions will then be given.

a. Notify emergency personnel by calling 811 on plant telephone or Station 1 on the transportation frequency or 373-3800 on the cellular phone.

b. If possible, isolate the fire to prevent spreading.

c. Evacuate the area. Use the main exit on Horn Rapids Road as the staging area.

d. Notify Siemens Nuclear Power Corp. personnel - phone 375-8100.

e. Notify Emergency Control Center on 376-5000, after calling 811.

19.2 Spill Response

In the event of a spill in the excavation or storage area from a broken or breached drum, take immediate action if the situation can be readily controlled with available resources without jeopardizing the safety of site personnel or the public. If necessary, evacuate personnel to the staging area according to the same routine discussed above. Verbal directions will then be given.

19.3 Chemical Exposure

Site workers must notify the SSO immediately in the event of any injury or any of the signs or symptoms of overexposure to hazardous substances, heat or cold stress, *etc.* Symptoms associated with the chemicals listed below should be made known to the SSO. Personnel should be made aware of the appropriate first aid treatment, also listed below.

Substance Present	Symptoms of Acute Exposure	First Aid
Carbon Tetrachloride	Skin irritant, nausea, vomiting, dizziness, drowsiness, and headache.	Wash affected area with soap and water. If appropriate, get to fresh air at once. Seek medical aid immediately.
Trichloroethene	Moderately toxic by ingestion and inhalation. Eye and skin irritant. Prolonged inhalation causes headaches and drowsiness. Acute inhalation exposure may be fatal.	Same as above.
Tetrachloroethane	Poisonous by ingestion and inhalation. Mildly toxic by skin contact.	Same as above.
1,1,1-Trichloroethane	Moderately toxic by ingestion, inhalation, or skin contact. Skin irritant. May cause cardiac arrest if inhaled in large doses.	Same as above.
Carbon Tetrachloride	Poisonous by ingestion and possibly through other routes. Mildly toxic by inhalation. An eye and skin irritant. Damages liver, kidney, and lungs. A suspected human carcinogen. The odor threshold for this compound is 70 ppm.	Same as above.
PCB	Moderately toxic by ingestion. Suspected human carcinogen. Affects skin and toxic to liver.	Same as above.
Chromium	Human poison by ingestion with gastrointestinal effects. Suspected carcinogen.	Seek medical aid immediately.
Arsenic	A human carcinogen. Human systemic, skin and gastrointestinal effects by ingestion.	Same as above.
Nickel	Poisonous by ingestion.	Same as above.
Nitrate	Health effects from nitrates depends largely on the chemical form of the radical.	Same as above.
Methane	Possible asphyxiant. Highly flammable.	Same as above.

19.4 Onsite Injury or Illness

In the event of an injury requiring more than minor first aid, or any employee reporting any sign or symptom of exposure to hazardous substances, immediately take the victim to Kadlec Hospital located at 888 Swift Boulevard., Richland, phone 946-4611.

In the event of life-threatening or traumatic injury, implement appropriate first aid and immediately call for emergency medical assistance at Station 1 or 373-3800. The nearest designated trauma center is located at Kadlec Hospital, phone 946-4611 .

19.5 Emergency Response Authority

Richard Fink is the designated Site Emergency Coordinator and has final authority for first response to onsite emergency situations. The FTL/SSO will be responsible to assure complete site evacuation, if necessary, during an emergency. Emergency drills will be conducted periodically. Upon arrival of the appropriate emergency response personnel, the Site Emergency Coordinator shall defer all authority, but shall remain on the scene to provide any and all possible assistance. At the earliest opportunity, the SSO or the Site Emergency Coordinator shall contact the following:

FUNCTION	NAME	Telephone (work)	Telephone (home)
Technical Manager	W. L. Greenwald	(509) 376-9698	(509) 547-9800
Health & Safety Officer	M. B. Remington	(509) 522-6782	(509) 529-3010
Environmental Engineering	R. A. Liias	(509) 522-6924	(509) 783-8711
Safety & Health Manager	D. W. Coonfare	(509) 522-6798	(509) 529-3453

20.0 LOGS, REPORTS, AND RECORDKEEPING

The following logs, reports, and records shall be developed, retained, and made available to the Department of Energy (DOE), regulating agencies, and to QA safety and health personnel upon request:

a. Training log.

b. Daily safety inspection log.

c. Employee/visitor register.

d. Medical opinions/certificates.

e. Environmental and personal decontamination verification certificates, summary of air monitoring data, final medical certificates (or proof of medical).

The MSDS are kept onsite and made available to anyone requesting them.

NOTE: All exposure and medical monitoring records are to be maintained in accordance with OSHA standards, USACE records system (MARKS), DOE Order 1324.2A, and DOE Richland implementation order 1324.1A - Records Disposition.

21.0 REFERENCES

Dangerous Properties of Industrial Materials; 1989; Irving N. Sax and Richard J. Lewis, Sr.; Seventh Edition; Vols. I, II, and III; Van Norstrand Reinhold, New York.

NIOSH Pocket Guide to Chemical Hazards; U.S. Department of Health and Human Services; June 1990.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities; National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (EPA); October 1985.

ER 385-1-2; *Safety and Occupational Health Document Requirements for Hazardous Waste Site Removal Actions*; 30 August 1984.

SAFETY BRIEFING CHECKLIST

The following personnel were present at a prejob safety briefing conducted at ____________ (time) on ____________ (date) at ________________________ (location), have read the above plan, and are familiar with its provisions:

Name	PN # or SS #	Signature

The following items will be checked and verified where applicable prior to start of work:

	Yes	N/A	Ver'd
Fully charged ABC Class fire extinguishers (2) available onsite?	[X]	[ ]	[ ]
Fully stocked first aid kit available onsite?	[X]	[ ]	[ ]
All project personnel advised of location of nearest phone?	[X]	[ ]	[ ]
Cellular phone onsite?	[X]	[ ]	[ ]
All project personnel advised of location of designated medical facility or facilities?	[X]	[ ]	[ ]
All PPE onsite?	[ ]	[X]	[ ]
SSHP covered in prejob safety meeting?	[X]	[ ]	[ ]
Warning/posting signs onsite? Rad/Chemical/Noise/No smoking?	[ ]	[X]	[ ]
Emergency pressurized eye/body wash station onsite?	[X]	[ ]	[ ]
All personnel advised of location of facility exits?	[ ]	[X]	[ ]
MSDS's available onsite?	[X]	[ ]	[ ]
Training records available onsite?	[X]	[ ]	[ ]
Copy of pertinent regulations onsite, OSHA, Army, EPA, *etc.*?	[X]	[ ]	[ ]

____
Printed Name of Field Team Leader or
Site Safety Officer

____
Signature   Date

FIELD PROCEDURES CHANGE AUTHORIZATION

Instruction Number to be changed:	Duration of Authorization [ ] Today Only [ ] Duration of Task	Date:

Description of Procedures Modified:

Justification:

Person Requesting Change	Verbal Authorization Received From
Name:	Name: Date:
Title:	Title:
Signature:	Signature:

(Signature of person named above to be obtained within 48 hours of verbal authorization)

APPENDIX E

PROJECT MANAGEMENT PLAN

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FIGURES

TABLE

1.0 INTRODUCTION

This Project Management Plan (PMP) defines the administrative and institutional tasks necessary to support the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) for the 1100-EM-1 Operable Unit at the Hanford Site. This plan defines the responsibilities of the various participants, the organizational structure, and the project tracking and reporting procedures.

The U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and the U.S. Department of Energy (DOE) have entered into the Hanford Federal Facility Agreement and Consent Order for remedial actions and corrective activities on the Hanford Site (Ecology *et al.*, 1989). An Action Plan, which is an attachment to and implements this agreement, defines EPA and Ecology regulatory integration and the methods and processes to be used to implement the agreement. This PMP is in accordance with the provisions of the latest Action Plan. Any revisions to the Action Plan that would result in changes to the project management requirements would supersede the provisions of this plan.

The progress in completing the RI/FS for the 1100-EM-1 Operable Unit will be documented through monthly project activity reports and coordination meetings. The monthly reports will include labor costs, expenses-to-date, and an estimate of the total percent completed. Additional tasks required for project management include:

- Writing, reviewing, and commenting on documents.
- Maintaining administrative record files.
- Distributing documents and correspondence.
- Maintaining formal change control system for modifying the work schedule in the Work Plan.
- Determining financial and project tracking requirements.
- Coordinating project activities between EPA, Ecology, DOE, and subcontractors.
- Determining if interim remedial action is required.
- Attending meetings.

This PMP discusses these and other details of project management. Execution of the PMP will require that all activities be performed cooperatively between DOE, EPA, and Ecology personnel.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 Interface of Regulatory Authorities and DOE

The 1100-EM-1 Operable Unit consists of inactive waste management units to be remedied under CERCLA. The EPA has been designated as the lead regulatory agency as defined in the Hanford Federal Facility Agreement and Consent Order (Ecology *et al.*, 1989). Accordingly, EPA is responsible for overseeing remedial action activity at this unit and ensuring that the applicable authorities of both EPA and Ecology are applied. The specific responsibilities of EPA, Ecology, and the DOE Field Office, Richland (DOE-RL) are detailed in the Action Plan.

2.2 Project Organization and Responsibilities

The project organization for implementing remedial activities at the 1100-EM-1 Operable Unit is shown in figure 1. The following sections describe the responsibilities of the individuals shown in this figure.

2.2.1 Project Managers

The EPA, DOE-RL, and Ecology have each designated one individual as project manager (PM) for remedial activities at the Hanford Site. These PM will serve as the primary point of contact for all activities to be carried out under the Hanford Federal Facility Agreement and Consent Order and the Action Plan (Ecology *et al.*, 1989). The responsibilities of the Pms are given in section 4.1 of the Action Plan.

2.2.2 Unit Managers

The EPA, DOE-RL, and Ecology have also each designated an individual as a unit manager for the 1100-EM-1 Operable Unit. The EPA Unit Manager serves as the lead unit manager and is responsible for regulatory oversight of all RI/FS activities required for the 1100-EM-1 Operable Unit. The Ecology Unit Manager is responsible for making decisions related to issues for which the supporting regulatory agency maintains authority. All such decisions will be made in consideration of recommendations made by the EPA Unit Manager. The DOE-RL Unit Manager is responsible for maintaining and controlling the schedule and budget, and for keeping the EPA and Ecology Unit Managers informed as to the status of the RI/FS activities at the 1100-EM-1 Operable Unit (particularly the status of agreements and commitments).

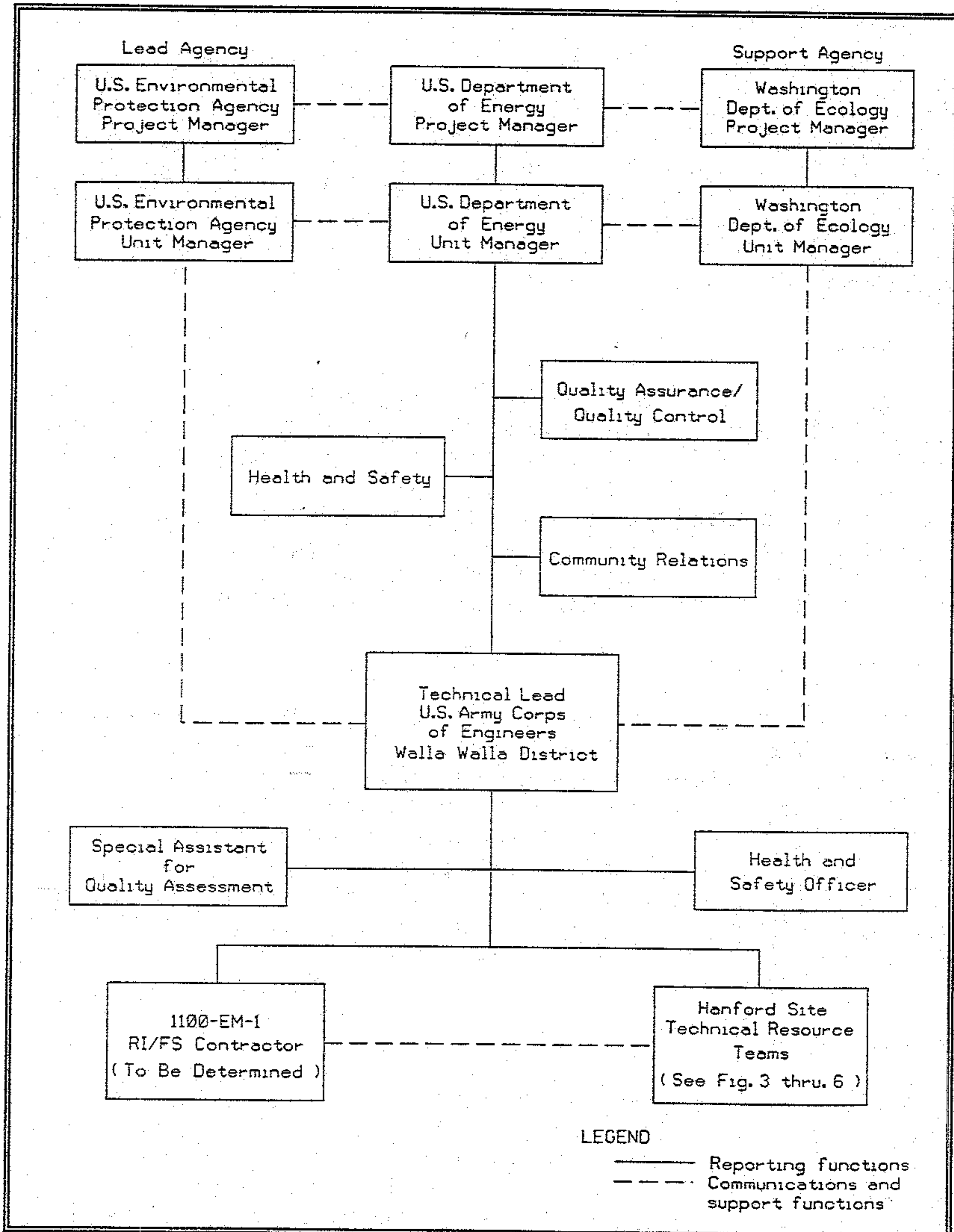

Figure 1. 1100-EM-1 Operable Unit RI/FS Project Organization.

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2.2.3 Quality Assurance

The EPA, DOE-RL, and Ecology will each designate an individual to be responsible for Quality Assurance/Quality Control (QA/QC) for the 1100-EM-1 Operable Unit. The EPA Quality Assurance Officer will support the EPA Unit Manager by providing regulatory oversight of all QA/QC matters relevant to the RI/FS activities. The Ecology Quality Assurance Officer will assist the Ecology Unit Manager with QA/QC issues relevant to the supporting agency's authority. The DOE-RL Quality Assurance Officer will support the DOE-RL Unit Manager with schedule and budget compliance, data and deliverable quality, and field operational procedures.

2.2.4 Health and Safety

The EPA, DOE-RL, and Ecology will each designate an individual to be responsible for health and safety for the 1100-EM-1 Operable Unit. The EPA Health and Safety Officer will support the EPA Unit Manager by providing health and safety oversight relevant to the RI/FS activities. The Ecology Health and Safety Officer will assist the Ecology Unit Manager with health and safety issues relevant to the supporting agency's authority. The DOE-RL Health and Safety Officer will support the DOE-RL Unit Manager with health and safety risk analysis, medical surveillance requirements, level of personnel protective equipment required, site control measures, and decontamination procedures.

2.2.5 Community Relations

The EPA, DOE-RL, and Ecology will each designate an individual to be responsible for Community Relations for the 1100-EM-1 Operable Unit. The EPA Community Relations Officer will support the EPA Unit Manager by providing community relations oversight relevant to the RI/FS activities. The Ecology Community Relations Officer will assist the Ecology Unit Manager with community relations issues relevant to the supporting agency's authority. The DOE-RL Community Relations Officer will support the DOE-RL Unit Manager with developing partnerships with the States and Northwest Indian nations, outreach to general public, information for presentation to the news media, and editing documents for public release.

2.2.6 Special Assistant for Quality Assessment

The U.S. Army Corps of Engineers Special Assistant for Quality Assessment (SAQA) is responsible for coordinating and monitoring implementation of 1100-EM-1 Operable Unit RI/FS Quality Assurance Project Plan (QAPjP) requirements by means of internal surveillance techniques and by auditing. The SAQA is an independent functional element specially vested with the necessary organizational independence and authority to identify conditions adverse to quality and to systematically seek effective corrective action.

2.2.7 Health and Safety Officer

The U.S. Army Corps of Engineers Health and Safety Officer is responsible for monitoring all potential health and safety hazards that may arise during work by the U.S. Army Corps of Engineers at the Hanford Site, including those associated with radioactive, volatile, and/or toxic compounds during field activities. The Health and Safety Officer has the responsibility and authority to halt field activities posing unacceptable health and safety hazards.

2.2.8 Site Safety Officer

The U.S. Army Corps of Engineers Site Safety Officer is responsible for coordinating and monitoring the implementation of the 1100-EM-1 Operable Unit Site Safety and Health Plan (SSHP) to protect field personnel, site visitors, and the general public. This will involve evaluating medical and training records, conducting safety briefings and training, auditing field safety procedures, and updating the SSHP as necessary. The SSHP will contain sufficient information to be equivalent to Hazardous Waste Operations Permits (HWOPs) and Radiation Work Permits (RWPs). Separate HWOPs and RWPs will not be developed. The Site Safety Officer retains the organizational independence and authority to suspend unsafe field activities until unacceptable health and safety hazards are corrected.

2.2.9 Technical Lead

The U.S. Army Corps of Engineers is the technical lead for the 1100-EM-1 Operable Unit RI/FS. Management of the technical lead responsibilities will be by a designated project team within the U. S. Army Corps of Engineers, Walla Walla District (CENPW). The leader of the project team is a PM assigned from Programs and Project Management Division, Hanford Program Office. The PM is responsible for managing the project parameters: cost, budget, schedule, scope, and quality, as well as interactions and relationships with those involved in the project process. The PM will be assisted by a lead technical manager (TM) assigned from Engineering Division, Environmental Engineering Branch. Other Tms from other CENPW functional offices, such as Safety and Health Office, may be assigned to the project team as necessary. The responsibilities of the TM will be to plan, authorize, and control work so that it can be completed on schedule and within budget, and to ensure that all planning and work performance activities are technically sound. The PM and TM will be responsible for coordinating all activities related to the RI/FS, including data collection, analysis, and reporting, and for keeping all 1100-EM-1 Operable Unit RI/FS participants informed of the current operable unit RI/FS status.

2.2.10 RI/FS Environmental Contractor

Figure 1 also shows the organizational relationship of the CENPW environmental contractor, should one be used to perform portions of the 1100-EM-1 Operable Unit RI/FS. The contractor would report directly to the CENPW Contracting Officer. The contractor will be directly responsible for planning data collection activities and for analyzing and reporting the results of the data gathering in the RI and FS reports. Figure 2 shows a sample organizational structure for an environmental contractor team. However, the CENPW Engineering Division, Environmental Engineering Branch TM would retain the responsibility for securing and managing the field sampling efforts of the Hanford Site technical resource teams described below:

2.2.11 Hanford Site Technical Resources

The numerous technical resources available on the Hanford Site for performing the RI field studies are shown in table 1. These and other resources, when necessary, will be utilized for performing data collection activities and analyses, and for reporting the results of specific technical activities related to the RI. Figures 3 through 6 show the detailed organizational structure of typical technical teams for specific activities. Internal and external work orders and subcontractor task orders will be written by the CENPW project team to use these technical resources.

Statements of work will be provided to the technical teams and will include a discussion of authority and responsibility, a schedule with clearly defined milestones, and a task description including specific requirements. Each technical team will keep the CENPW PM and TM informed on the RI work status performed by that group and of any problems that may arise.

3.0 DOCUMENTATION AND RECORDS

All RI/FS plans and reports will be categorized as either primary or secondary documents as described by section 9.1 of the Action Plan. The process for document review and comment will be as described in section 9.2 of the Action Plan. Revisions, should they become necessary after finalization of any document, will be in accordance with section 9.3 of the Action Plan. Changes in the work schedule, as well as minor field changes, can be made without having to process a formal revision. The process for making these changes will be as stated in section 12.0 of the Action Plan. Administrative records, which must be maintained to support the Hanford Site CERCLA activities, will be in accordance with section 9.4 of the Action Plan.

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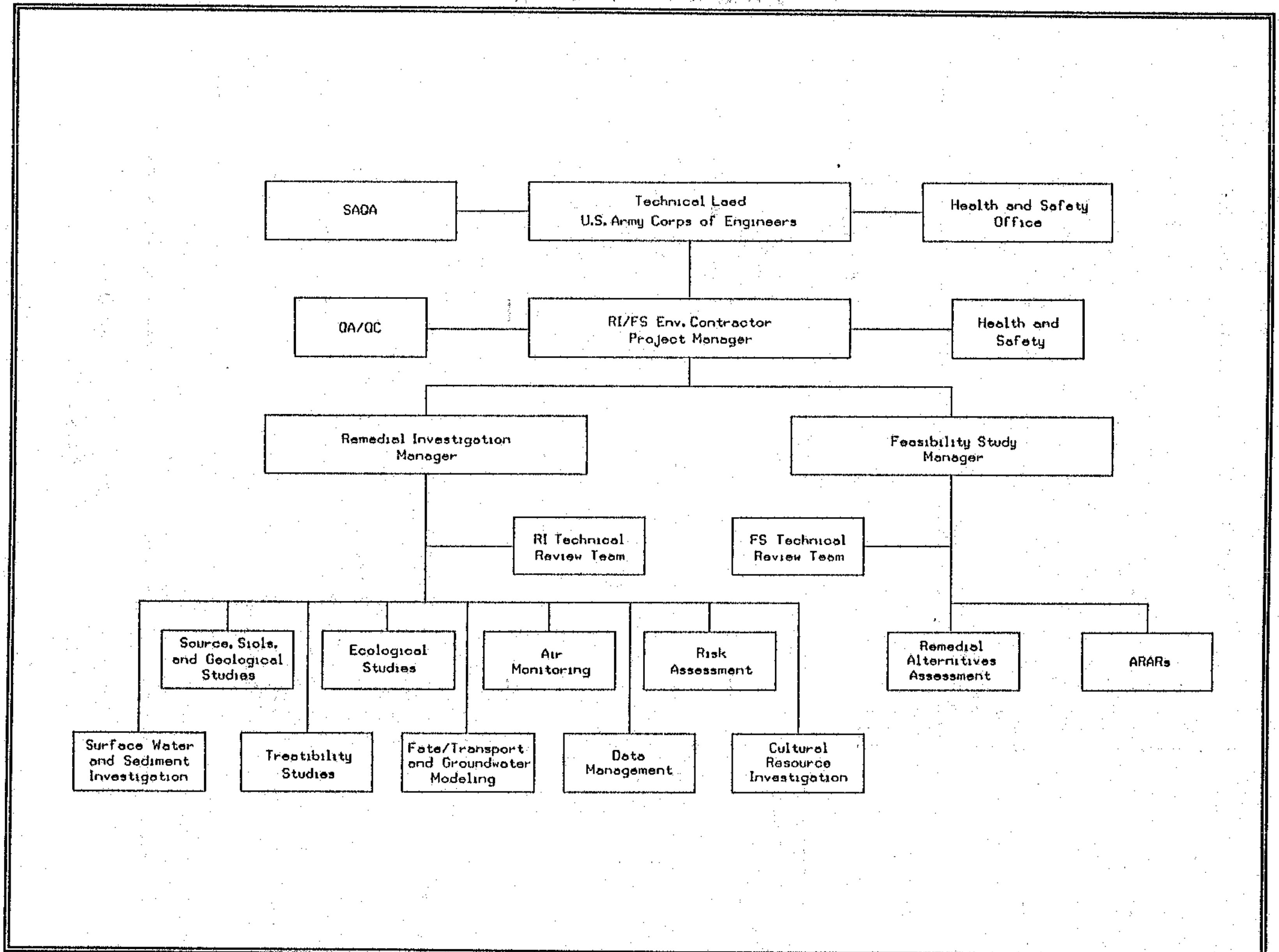

Figure 2. Typical Project Organization for 1100-EM-1 Operable Unit Remedial Investigation/Feasibility Study Contractor Team

Subject/Activity	Remedial Investigation	Feasibility Study
Hydrology and Geology	CENPW WHC/Geosciences PNL/Earth and Environmental Sciences Center	CENPW WHC/Geosciences
Toxicology and Risk/ Endangerment Assessment	CENPW WHC/Environmental Technology PNL/Earth and Environmental Sciences Center PNL/Life Sciences Center	CENPW WHC/Environmental Technology
Environmental Chemistry	CENPW WHC/Geosciences PNL/Earth and Environmental Sciences Center	CENPW WHC/Geosciences
Geotechnical and Civil Engineering	CENPW WHC/Geosciences (Planning) WHC/Environmental Field Services	CENPW WHC/Environmental Engineering PNL/Waste Technology Center
Groundwater Treatment Engineering	N/A	CENPW WHC/Environmental Engineering PNL/Waste Technology Center
Waste Stabilization and Treatment	N/A	CENPW WHC/Environmental Engineering PNL/Waste Technology Center
Surveying	CENPW KEH	N/A
Soil and Water Sampling and Analysis	CENPW WHC/Environmental Engineering WHC/Environmental Field Services WHC/ Office of Sample Management PNL/Earth and Environmental Sciences Center PNL/Materials and Chemical Sciences Center	N/A
Drilling and Well Installation	CENPW WHC/Geosciences WHC/Environmental Field Services KEH	N/A
Radiation Monitoring	CENPW WHC/Operational Health Physics	N/A

Table 1. Technical Resources for 1100-EM-1 Operable Unit Remedial Investigation/Feasibility Study

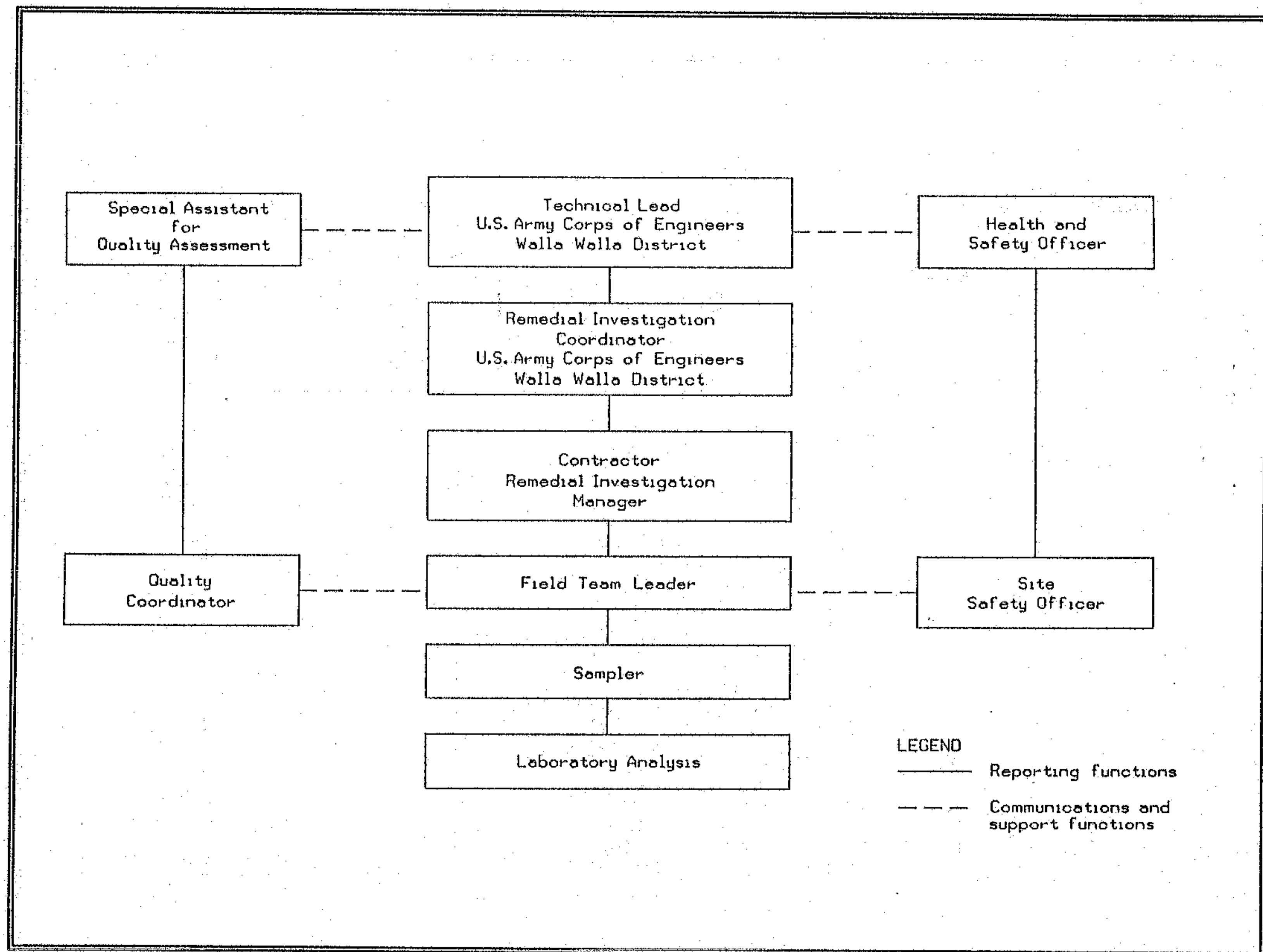

Figure 3. Typical Management Structure for Site Soil Sampling Effort

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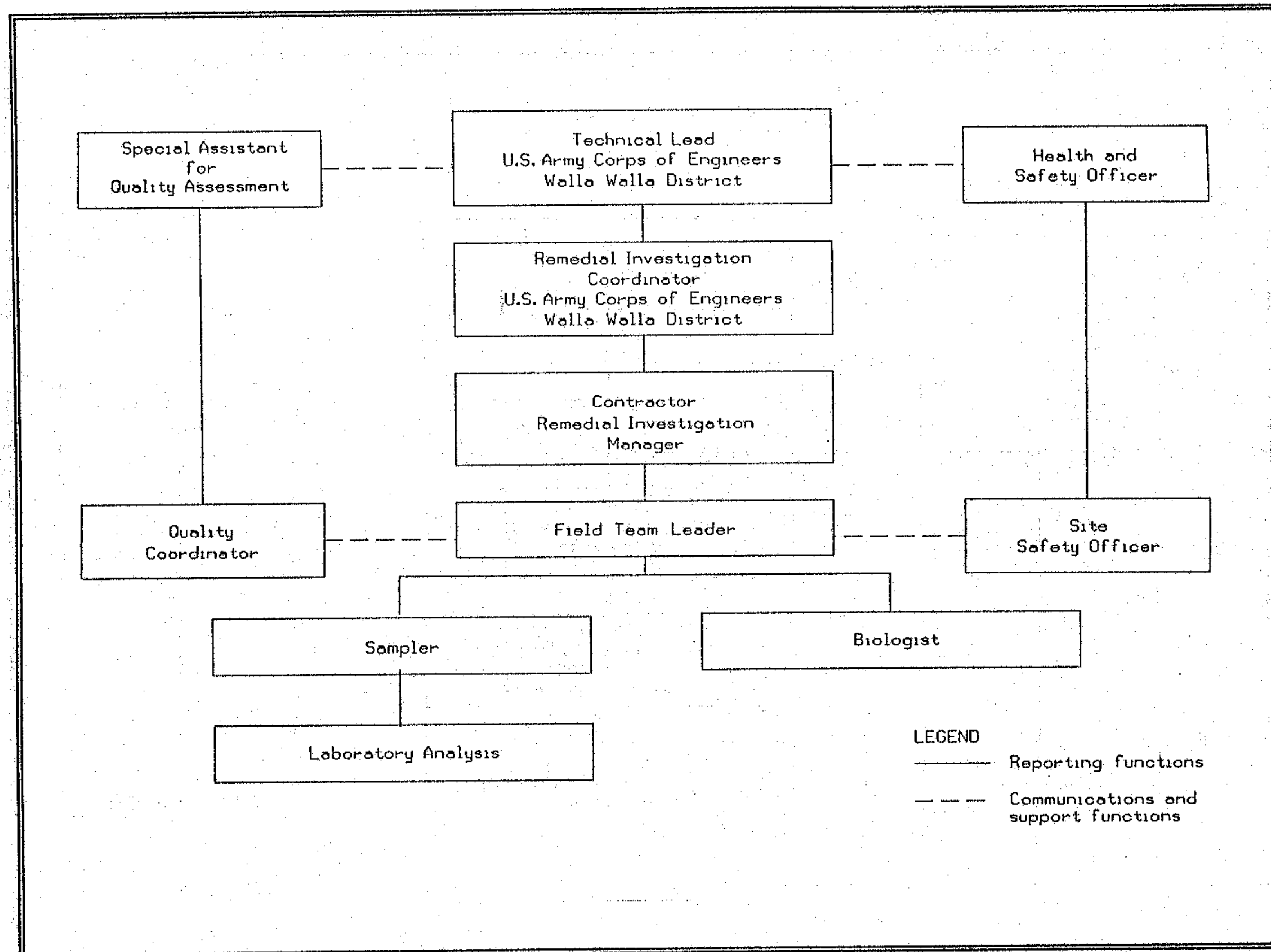

Figure 4. Typical Management Structure for Ecological Sampling Effort

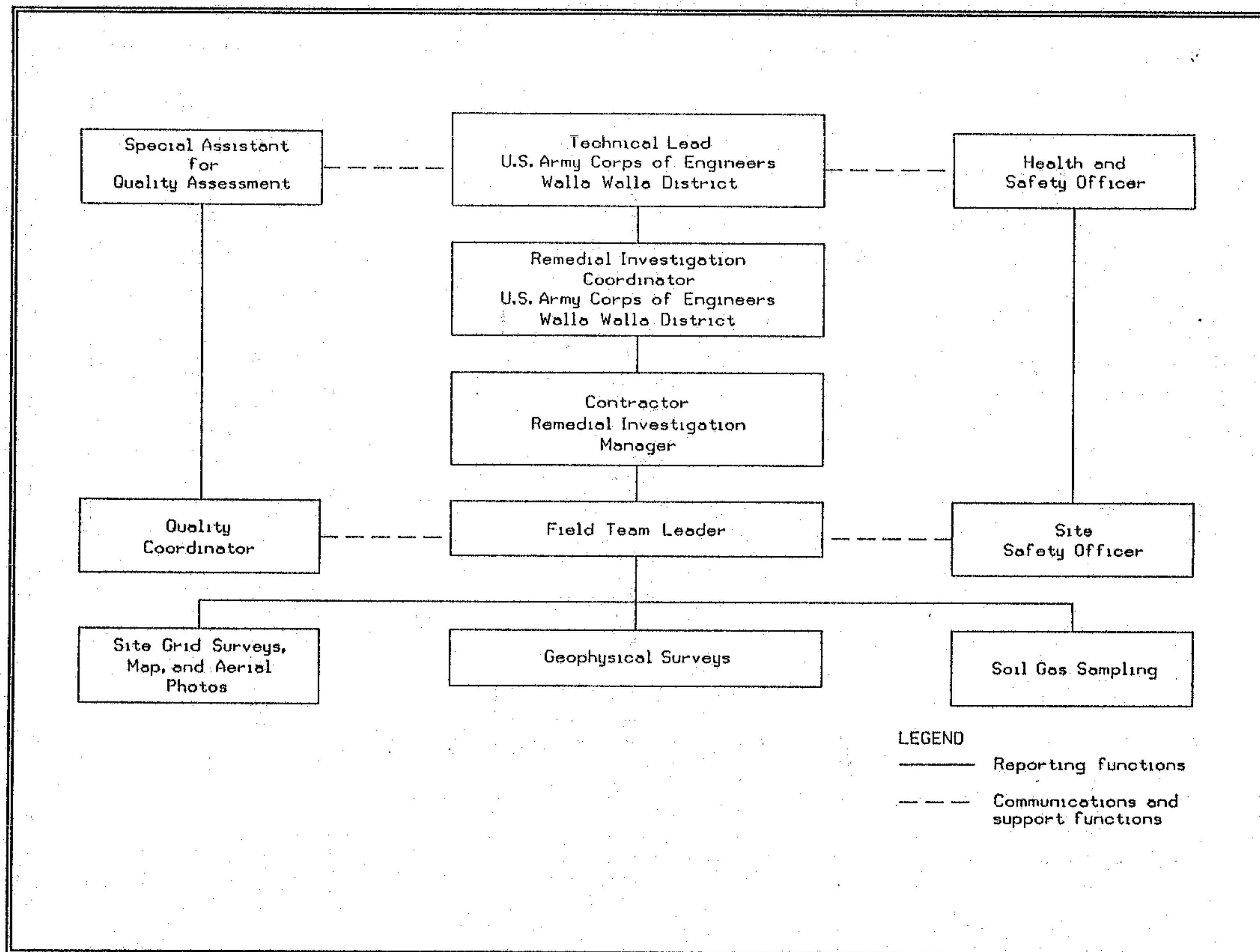

Figure 5. Typical Management Structure for Physical and Geophysical Survey Effort

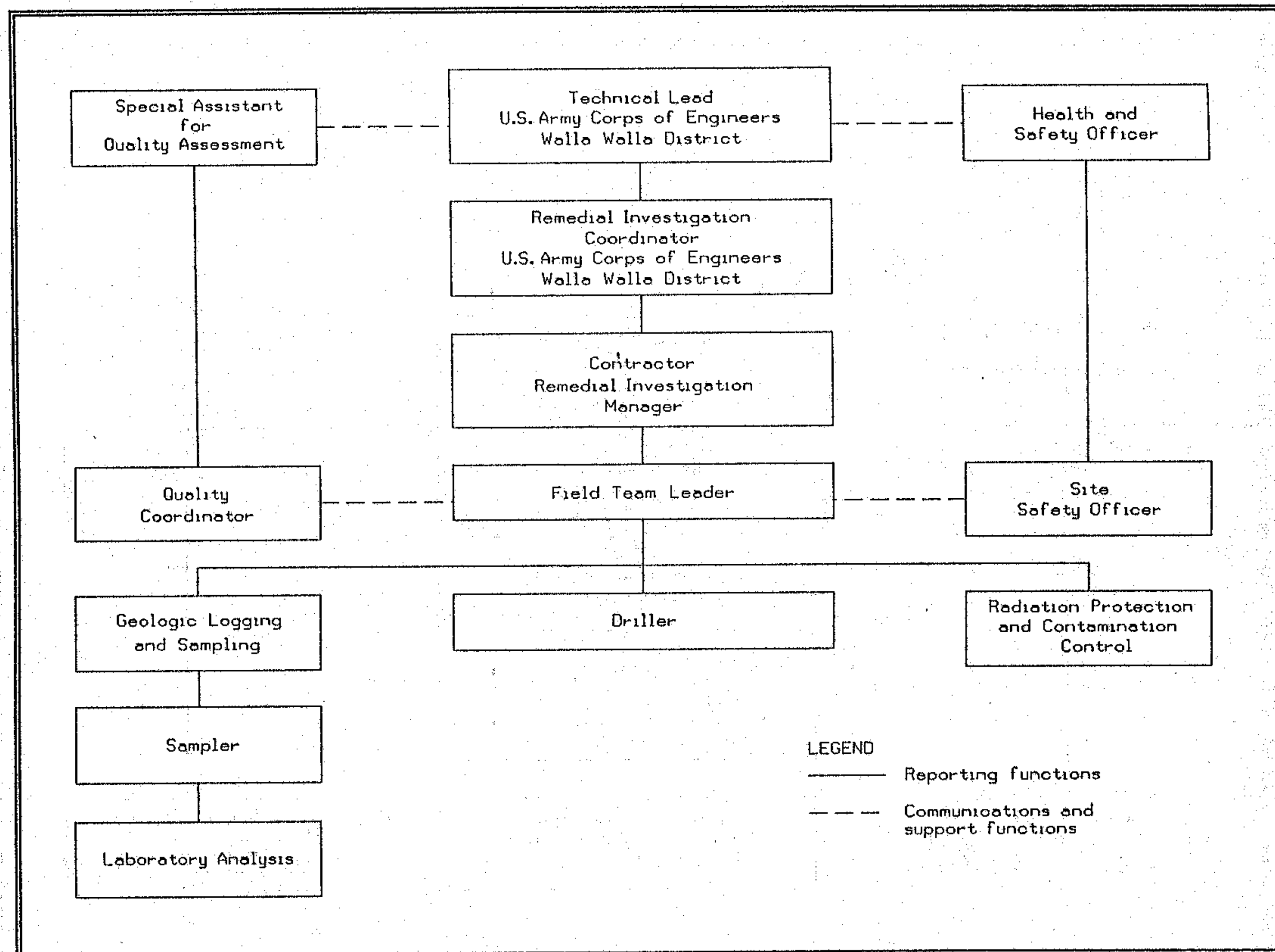

Figure 6. Typical Management Structure for Vadose Zone Drilling and Sampling Effort

4.0 FINANCIAL AND PROJECT TRACKING REQUIREMENTS

4.1 Management Control

The CENPW will have the overall responsibility for planning and controlling the RI/FS activities and providing effective technical, cost, and schedule baseline management. The U.S. Army Corps of Engineers will also assume responsibility for managing its RI/FS environmental contractor (if one is used). The contractor will assume the direct day-to-day responsibilities for the managed functions. The management control system used for this project must meet the requirements of DOE Order 4700.1, *Project Management System* (DOE 1987); and DOE Order 2250.1B, (DOE 1985) *Cost and Schedule Systems Criteria for Contract Performance Measurement*. The U.S. Army Corps of Engineers *Project Management System* (Engineer Regulation 5-7-1) (1991) meets these requirements. The primary goals of the *Project Management System* are to provide methods for planning, authorizing, and controlling work so that it can be completed on schedule and within budget, and to ensure that all planning and work performance activities are technically sound and in conformance with management and quality requirements.

The RI/FS schedule for the 1100-EM-1 Operable Unit and major milestones are described in Chapter 5.0 of this document. The schedule in the Supplemental Work Plan will be the primary vehicle for the unit manager and technical lead to track the progress of the RI/FS for the 1100-EM-1 Operable Unit. The RI/FS schedule is consistent with the work schedule contained in the Action Plan.

The RI/FS schedule in the Supplemental Work Plan will be updated at least annually, to include the current fiscal year and the following year. In addition, any approved schedule changes (see section 12.0 of the Action Plan for the formal change control system) would be incorporated at this time if not previously incorporated. This update will be performed in the fourth quarter (*e.g.*, July to September) for the upcoming fiscal year. The work schedule can be revised at any time during the year if the need arises, but the changes would be restricted to major changes that would not be suitable for the change control process.

4.2 Meetings and Progress Reports

Both PMs and unit managers for DOE-RL, EPA, and Ecology must meet periodically to discuss progress, review plans, and address any issues that have arisen. The PMs' meeting will take place at least quarterly as discussed in section 8.1 of the Action Plan.

Unit managers will meet monthly to discuss progress, address issues, and review near-term plans pertaining to their respective operable units and/or treatment, storage, and disposal groups/units. The meetings will be technical in nature with emphasis on technical issues and work progress. The assigned DOE-RL Unit Manager for the 1100-EM-1 Operable Unit will be responsible for preparing revisions to the RI/FS schedule prior to the meeting. The schedule will address all ongoing activities associated with the operable unit, including actions on specific source units (*e.g.*, sampling). This schedule will be provided to all parties and reviewed at the meeting. Any agreements and commitments (within the unit manager's level of authority) resulting from the meeting will be prepared and signed by all parties as soon as possible after the meeting. Meeting minutes will be issued by the DOE-RL Unit Manager and will summarize the discussion at the meeting, with information copies given to the PMs. The minutes will be issued within 10 working days following the meeting. The minutes will include, at a minimum, the following information:

- Status of previous agreements and commitments,
- Any new agreements and commitments,
- Schedules (with current status noted), and
- Any approved changes signed off at the meeting in accordance with section 12.1 of the Action Plan.

The DOE-RL will issue a quarterly progress report for the Hanford Site within 45 days following the end of each quarter. Quarters end on March 30, June 30, September 30, and December 31. The report will include:

- Highlights of significant progress and problems.
- Technical progress with supporting information, as appropriate.
- Problem areas with recommended solutions. This will include any anticipated delays in meeting schedules, the reason(s) for the potential delay, and actions to prevent or minimize the delay.
- Significant activities planned for the next quarter.
- Work schedules (with current status noted).

The quarterly progress reports will be placed in the public information repositories as discussed in section 10.2 of the Action Plan.

5.0 REFERENCES

U.S. Army Corps of Engineers, 1991, *Project Management System*, Engineer Regulation 5-7-1, U.S. Army Corps of Engineers, Washington, D.C.

U.S. Department of Energy, 1985, *Cost and Schedule Control Systems Criteria for Contract Performance Measurement*, DOE Order 2250.1B, U.S. Department of Energy, Washington, D.C.

U.S. Department of Energy, 1987, *Project Management System*, DOE Order 4700.1, U.S. Department Of Energy, Washington, D.C.

Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, May 1989, *Hanford Federal Facility Agreement and Consent Order*, 89-10.

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